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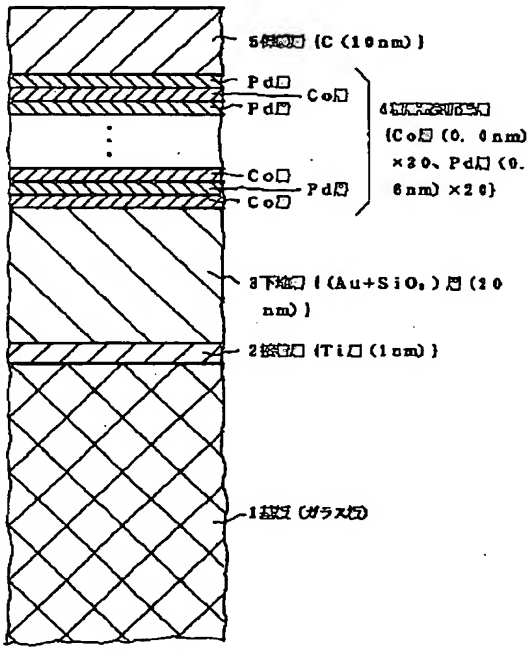
(54)【発明の名称】　磁気記録媒体

(57)【要約】
【課題】　Ｃｏと、Ｐｔ又はＰｄとを交互に積層した積層磁気記録層を有する磁気記録媒体において、積層磁気記録層における遷移ノイズが大幅に減少して、短波長記録に好適なものを得る。
【解決手段】　Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層４と、その積層磁気記録層４に対する下地層３とを有する磁気記録媒体において、下地層３を、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はＳｉ$_3$Ｎ$_4$、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなる複合材料層にて構成した磁気記録媒体である。



磁気記録媒体の例

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【特許請求の範囲】

【請求項１】　Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層と、該積層磁気記録層に対する下地層とを有する磁気記録媒体において、

上記下地層は、

Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなる複合材料層にて構成されてなることを特徴とする磁気記録媒体。

【請求項２】　Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層を有する磁気記録媒体において、

上記積層磁気記録層は、

Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなり、厚さが０．３ｎｍ以上１０ｎｍ以下の分断層によって、複数の層に分割されてなることを特徴とする磁気記録媒体。

【請求項３】　Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層と、該積層磁気記録層に対する下地層とを有する磁気記録媒体において、

上記下地層は、

Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなる複合材料層にて構成されると共に、

上記積層磁気記録層は、

Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなり、厚さが０．３ｎｍ以上１０ｎｍ以下の分断層によって、複数の層に分割されてなることを特徴とする磁気記録媒体。

【請求項４】　ＮｉＦｅ、ＣｏＺｒ、ＦｅＮ等のいずれかからなる軟磁性層と、

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該軟磁性層上に形成された、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなり、厚さが１ｎｍ以上３０ｎｍ以下の厚さの複合材料層と、

該複合材料層の上に形成された、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層とを有することを特徴とする磁気記録媒体。

【請求項５】　請求項１に記載の磁気記録媒体において、

上記積層磁気記録層と、上記下地層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又は該金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなることを特徴とする磁気記録媒体。

【請求項６】　請求項２に記載の磁気記録媒体において、

上記積層磁気記録層の上記分断層によって分割された各層と、上記分断層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又は該金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなることを特徴とする磁気記録媒体。

【請求項７】　請求項３に記載の磁気記録媒体において、

上記積層磁気記録層の上記分断層によって分割された各層と、上記分断層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又は該金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなることを特徴とする磁気記録媒体。

【請求項８】　請求項３に記載の磁気記録媒体において、

上記積層磁気記録層と、上記下地層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又は該金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなることを特徴とする磁気記録媒体。

【請求項９】　請求項４に記載の磁気記録媒体において、

上記積層磁気記録層と、上記複合材料層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又は該金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚

さの保磁力低下抑制層が介在せしめられてなることを特徴とする磁気記録媒体。

【請求項１０】　請求項２に記載の磁気記録媒体において、

上記積層磁気記録層の上記分断層によって分割された各層の厚さが、３ｎｍ以上２０ｎｍ以下に設定されてなることを特徴とする磁気記録媒体。

【請求項１１】　請求項３に記載の磁気記録媒体において、

上記積層磁気記録層の上記分断層によって分割された各層の厚さが、３ｎｍ以上２０ｎｍ以下に設定されてなることを特徴とする磁気記録媒体。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、ハードディスク、磁気テープ、フロッピーディスク、光磁気ディスク等に適用して好適な磁気記録媒体に関する。

【０００２】

【従来の技術】磁気記録媒体に対する面内磁気記録は、記録情報の高密度化に伴って、記録磁化が時間の経過に従って減衰する熱減磁が問題となって来ている。

【０００３】この磁気記録媒体に対する面内磁気記録の問題点を解決する手法の１つとして、垂直磁気記録がある。かかる垂直磁気記録用磁気記録媒体の磁性材料として、ＣｏＣｒ合金が広く研究されている。

【０００４】しかしながら、垂直磁気記録用磁気記録媒体の磁性材料としてのＣｏＣｒ合金の垂直磁気異方性は飽和磁化より小さいため、垂直角形比が１にならないという欠点がある。このため、ＣｏＣｒ合金の磁性層は、長波長記録部分で反転磁化領域が発生し、それがノイズの原因となることが知られている。

【０００５】この問題を解決するためには、垂直磁気記録用磁気記録媒体の磁性層として、垂直磁気異方性の大きな材料を用いれば良く、そのような磁性層としては、Ｃｏと、Ｐｔ又はＰｄとを交互に積層した積層磁性層がある。

【０００６】以下に、図１４を参照して、かかるＣｏと、Ｐｔ又はＰｄとを交互に積層した積層磁性層を記録層とした従来の磁気記録媒体を説明する。１は基板で、これの材質は、磁気記録媒体の種類に応じて異なるが、ここでは、例えば、ガラス板である。基板１の上には、厚さが１ｎｍのＴｉ層からなる接着層２を介して、厚さが２０ｎｍのＰｔ層からなる下地層３が被着形成されている。下地層３上には、厚さが０．６ｎｍのＣｏ層と、厚さが０．８ｎｍのＰｔ層が交互に、それぞれ２０枚ずつ積層された積層磁気記録層４が被着形成されている。積層磁気記録層４上には、厚さが１０ｎｍのＣからなる保護層５が被着形成されている。

【０００７】図１５に、図１４に図示した従来の磁気記録媒体の面内方向及び垂直方向磁化曲線を示す。図１５において、横軸は磁化の強さＨ（ｋＯｅ）を示し、縦軸は磁化Ｍを示す。図１６に、図１４に図示した従来の磁気記録媒体における、その磁気記録媒体によって一定周波数の信号を記録及び再生したときの再生スペクトルを示す。図１６において、横軸はｆ（周波数）（ＭＨｚ）を示し、縦軸はノイズレベル（ｄＢ）を示す。尚、図１５及び図１６の特性の評価については、後述する。

【０００８】

【発明が解決しようとする課題】ところで、かかるＣｏと、Ｐｔ又はＰｄとを交互に積層した積層磁気記録層を有する磁気記録媒体は、積層磁気記録層の垂直磁気異方性が飽和磁化より十分大きいので、積層磁気記録層におけるノイズの発生は少ないが、その反面遷移ノイズが多いので短波長記録に不向きである。

【０００９】かかる点に鑑み、本発明は、Ｃｏと、Ｐｔ又はＰｄとを交互に積層した積層磁気記録層を有する磁気記録媒体において、積層磁気記録層における遷移ノイズが大幅に減少して、短波長記録に好適なものを提案しようとするものである。

【００１０】ところで、かかるＣｏと、Ｐｔ又はＰｄとを交互に積層した積層磁気記録層を有する従来の磁気記録媒体は、積層磁気記録層が厚くなると、結晶粒の増大によって、出力の増加以上にノイズが増えて、Ｓ／Ｎが劣化するという欠点がある。

【００１１】かかる点に鑑み、本発明は、Ｃｏと、Ｐｔ又はＰｄとを交互に積層した積層磁気記録層を有する磁気記録媒体において、積層磁気記録層が厚くても、結晶粒の増大を抑えて、Ｓ／Ｎの劣化を抑制することのできるものを提案しようとするものである。

【００１２】又、本発明は、Ｃｏと、Ｐｔ又はＰｄとを交互に積層した積層磁気記録層を有する磁気記録媒体において、遷移ノイズが大幅に減少して、短波長記録に好適であると共に、積層磁気記録層が厚くても、結晶粒の増大を抑えて、Ｓ／Ｎの劣化を抑制することのできるものを提案しようとするものである。

【００１３】ところで、Ｃｏと、Ｐｔ又はＰｄとを交互に積層した積層磁気記録層を有する磁気記録媒体において、その積層磁気記録層の下に軟磁性層を設けると、記録遷移が明瞭に書けることになるが、その反面、積層磁気記録層におけるノイズが増加することが多いことが分かった。ここで、「記録遷移が明瞭に書ける」は、結晶粒が小さくなり、且つ、粒間の磁気的相互作用が小さくなって、記録遷移のにじみが少なくなることを意味する。

【００１４】かかる点に鑑み、本発明は、Ｃｏと、Ｐｔ又はＰｄとを交互に積層した積層磁気記録層を有する磁気記録媒体において、積層磁気記録層の下に軟磁性層を設けることによって、記録遷移が明瞭に書けると共に、その軟磁性層の存在によって積層磁気記録層におけるノイズの増加を抑制することのできるものを提案しようと

するものである。

【００１５】ところで、Ｃｏと、Ｐｔ又はＰｄとを交互に積層した積層磁気記録層が設けられた磁気記録媒体において、その積層磁気記録層に対する下地層として、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料を設けると、積層磁気記録層における遷移ノイズが大幅に減少して、短波長記録に好適な磁気記録媒体が得られることを、本発明者は、研究の結果、見い出したが、その積層磁気記録層が薄いと、保磁力が低下することが分かった。

【００１６】かかる点に鑑み、本発明は、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層と、その積層磁気記録層に対する下地層とを有する磁気記録媒体であって、その下地層として、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料を設けた磁気記録媒体において、積層磁気記録層が薄くても、保磁力の低下を抑制することのできるものを提案しようとするものである。

【００１７】ところで、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層と、その積層磁気記録層に対する下地層とを有する磁気記録媒体であって、その下地層として、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料を設け、積層磁気記録層が、厚さが０．３ｎｍ以上１０ｎｍ以下の分断層によって、複数の層に分割されてなる磁気記録媒体は、積層磁気記録層が厚くても、結晶粒の増大を抑えて、Ｓ／Ｎの劣化を抑制することができるが、積層磁気記録層のその分断層によって分割された各層が薄いと、保磁力が低下することが分かった。

【００１８】かかる点に鑑み、本発明は、Ｃｏと、Ｐｔ又はＰｄとを交互に積層した積層磁気記録層を有する磁気記録媒体において、積層磁気記録層が厚くても、結晶粒の増大を抑えて、Ｓ／Ｎの劣化を抑制することができると共に、積層磁気記録層のその分断層によって分割された各層が薄くても、保磁力の低下しないものを提案しようとするものである。

【００１９】ところで、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層と、その積層磁気記録層に対する下地層とを有する磁気記録媒体であって、その積層磁気記録層が、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなり、厚さが０．３ｎｍ以上１０ｎｍ以下の分断層によって、複数の層に分割されてなる磁気記録媒体は、積層磁気記録層が厚くても、結晶粒の増大を抑えて、Ｓ／Ｎの劣化を抑制することができるが、その反面、積層磁気記録層の分断層によって分割された各層の厚さが３ｎｍより小さいと十分な保磁力が得られず、又、２０ｎｍより大きいと、十分なノイズ低減効果が得られない。

【００２０】かかる点に鑑み、本発明は、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層を有する磁気記録媒体において、積層磁気記録層が厚くても、結晶粒の増大を抑えて、Ｓ／Ｎの劣化を抑制することができると共に、十分な保磁力が得られ、且つ、十分なノイズ低減効果の得られるものを提案しようとするものである。

【００２１】

【課題を解決するための手段】第１の本発明は、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層と、その積層磁気記録層に対する下地層とを有する磁気記録媒体において、下地層は、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなる複合材料層にて構成されてなる磁気記録媒体である。

【００２２】かかる第１の本発明によれば、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層に対する下地層がＰｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなる複合材料層にて構成されているために、積層磁気記録層における遷移ノイズが大幅に減少する。

【００２３】第２の本発明は、Ｐｔ層（又はＰｄ層）及

びＣｏ層からなる積層磁気記録層を有する磁気記録媒体において、積層磁気記録層は、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなり、厚さが０．３ｎｍ以上１０ｎｍ以下の分断層によって、複数の層に分割されてなる磁気記録媒体である。

【００２４】第３の本発明は、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層と、その積層磁気記録層に対する下地層とを有する磁気記録媒体において、下地層は、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなる複合材料層にて構成されると共に、積層磁気記録層は、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなり、厚さが０．３ｎｍ以上１０ｎｍ以下の分断層によって、複数の層に分割されてなる磁気記録媒体である。

【００２５】第４の本発明は、ＮｉＦｅ、ＣｏＺｒ、ＦｅＮ等のいずれかからなる軟磁性層と、その軟磁性層上に形成された、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなり、厚さが１ｎｍ以上３０ｎｍ以下の厚さの複合材料層と、その複合材料層の上に形成された、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層とを有する磁気記録媒体である。

【００２６】第５の本発明は、第１の本発明において、積層磁気記録層と、下地層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又はその金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなる磁気記録媒体である。

【００２７】第６の本発明は、第２の本発明において、積層磁気記録層の分断層によって分割された各層と、分断層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又はその金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなる磁気記録媒体である。

【００２８】第７の本発明は、第３の本発明において、積層磁気記録層の分断層によって分割された各層と、分断層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又はその金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなる磁気記録媒体である。

【００２９】第８の本発明は、第３の本発明において、積層磁気記録層と、下地層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又はその金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなる磁気記録媒体である。

【００３０】第９の本発明は、第４の本発明において、積層磁気記録層と、複合材料層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又はその金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなる磁気記録媒体である。

【００３１】第１０及び第１１の本発明は、それぞれ第２及び第３の本発明において、積層磁気記録層の複合材料層によって分割された各層の厚さが、３ｎｍ以上２０ｎｍ以下に設定されてなる磁気記録媒体である。

【００３２】

【発明の実施の形態】先ず、図１を参照して、本発明の実施の形態の磁気記録媒体の一例を説明する。１は基板で、これの材質は、磁気記録媒体の種類に応じて異なるが、ここでは、例えば、ガラス板である。基板１の上には、接着層２を介して、下地層２が被着形成される。基板１がガラス板の場合、接着層２としては、例えば、Ｔｉが使用され、その厚さは、例えば、１ｎｍである。

【００３３】そして、下地層３上に、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層４が被着形成される。この積層磁気記録層４は、ここでは、厚さが、例えば、０．６ｎｍのＰｄ層と、厚さが、例えば、０．６ｎｍのＣｏ層とが、それぞれ２０枚ずつ交互に積層されたものである。

【００３４】積層磁気記録層４上には、保護層５が被着形成されている。この保護層５は、ここでは、例えば、１０ｎｍ厚のＣから構成される。

【００３５】上述の下地層２は、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなる複合材料層にて構成される。下地層２がかかる組成を有することにより、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層４有する磁気記録媒体に見られる遷移ノイズを大きく減少させることができる。ここでは、下地層２は、例えば、Ａｕと、SiO_2とのとの複合材料からなる複合材料層からなり、その厚さは、例えば、２０ｎｍである。

【００３６】下地層２に用いられる上述の面心立法構造の金属であるＰｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕは、特に、酸化や窒化等の化学的変化を受け難い材料が選ばれており、合金も可能である。下地層２に用いられる上述のSiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）は、Ｓｉ、Ａｌ、Ｔｉ等の酸素や窒素と結合し易い元素と、酸素、窒素、炭素等との化合物からなる。

【００３７】図２に、図１の実施の形態の磁気記録媒体の面内方向及び垂直方向磁化曲線を示す。図２において、横軸は磁化の強さＨ（ｋＯｅ）を示し、縦軸は磁化Ｍを示す。図２の面内方向磁化曲線の傾き（ｄＭ／ｄＨ）は、図１５の面内方向磁化曲線の傾き（ｄＭ／ｄＨ）に比べて急峻であるので、磁性粒子間の相互作用が少なく、このため再生信号に含まれるノイズの少ない磁気記録媒体が得られる。

【００３８】図３は、図１の磁気記録媒体の一例に一定周波数の信号を記録及び再生したときの再生スペクトルを示す。図３において、横軸はｆ（周波数）（ＭＨｚ）を示し、縦軸はノイズレベル（ｄＢ）を示す。

【００３９】図３及び図１６の再生スペクトルは、直径が２．５インチのガラス製ディスク上に、それぞれ図１及び図１４の磁気記録媒体をそれぞれ成膜し、そのディスクを磁気ヘッドに対する相対速度が１５ｍ／secになるように回転させ、記録トラック幅が１．２μｍのＭＲヘッド（磁気抵抗ヘッド）で周波数が５０ＭＨｚの信号を、成膜された磁気記録媒体に記録し、その記録信号を再生トラック幅が０．９μｍのＭＲヘッドで再生して、測定したものである。図３及び図１６の再生スペクルを比較すると、図３の方が図１６よりノイズレベルが低いことが分かる。

【００４０】図１の磁気記録媒体の下地層３のターゲットのＡｕの被膜率（％）と、膜中に含まれるＡｕ比体積比（％）との間の関係を、図４に特性曲線として図示した。この測定の際の下地層３を構成するＡｕ及びSiO_2の体積比は、Ａｕ：６０％、SiO_2：４０％であった。

【００４１】図５に、図１における磁気記録媒体における積層磁気記録層４におけるＣｏ層の厚さを０．６ｎｍから０．５ｎｍに変更し、厚さが０．８ｎｍのＰｄ層を厚さが１ｎｍのＰｔ層に変更すると共に、下地層３を、厚さが２０ｎｍの（Ａｕ＋Al_2O_3）層から、厚さが２０ｎｍの（Ｐｔ＋Al_2O_3）層に変更した場合における、下地層３中のＰｔの体積比（％）に対する垂直方向の保磁力Ｈｃ（ｋＯｅ）及び信号対ノイズの比（Ｓ／Ｎ）（ｄＢ）との間の関係を、特性曲線として示したものである。この場合、半径が２．５インチのガラス製ディスク上に、磁気記録媒体をそれぞれ成膜し、そのディスクを磁気ヘッドに対する相対速度が１５ｍ／secになるように回転させ、記録トラック幅が１．２μｍのＭＲヘッド（磁気抵抗ヘッド）で周波数が５０ＭＨｚの信号を、成膜された磁気記録媒体に記録し、その記録信号を再生トラック幅が０．９μｍＭＲヘッドで再生し、その再生信号中の５０ＭＨｚの信号と、０ＭＨｚから８０ＭＨｚまでのノイズを積分したノイズ強度との比をＳ／Ｎとした。

【００４２】次に、図６を参照して、本発明の実施の形態の磁気記録媒体の他の例を説明する。この磁気記録媒体で、基板１、接着層２、下地層３及び保護層５は図１の磁気記録媒体の一例と同じなので、その説明を省略し、積層磁気記録層４について説明する。

【００４３】ところで、図１に示した如き磁気記録媒体では、積層磁気記録４が厚くなると、結晶粒の増大により、出力の増加以上にノイズが増加して、信号対ノイズ比（Ｓ／Ｎ）が劣化する。

【００４４】そこで、この磁気記録媒体の積層磁気記録層４は、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層が、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなり、厚さが０．３ｎｍ以上１０ｎｍ以下の分断層６によって、複数の層に分割されて構成される。

【００４５】積層磁気記録層４がこのように構成されていることにより、分断層６によって、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層における結晶粒の成長が抑えられて、その積層磁気記録層が厚くても、ノイズの増加が抑えられる。

【００４６】分断層６の厚さが０．３ｎｍより薄い場合は、十分なノイズ低減効果が得られず、又、１０ｎｍよ

り厚い場合は、積層磁気記録層４の厚さが厚くなり過ぎて、高密度記録時に十分な記録が行えなくなる。

【００４７】図６の例では、厚さが、例えば、厚さが０．６ｎｍのＰｄ層と、厚さが、例えば、０．６ｎｍのＣｏ層とが、それぞれ２０枚ずつ交互に積層されたＰｄ層及びＣｏ層からなる３０組の層からなる積層磁気記録層を、例えば、厚さが０．６ｎｍの（Ａｕ＋SiO_2）層からなる２枚の分断層６によって、３分割して、１０組ずつのＰｄ層及びＣｏ層に分割する。

【００４８】次に、図７を参照して、本発明の実施の形態の磁気記録媒体の他の例を説明する。この磁気記録媒体で、基板１、接着層２、積層磁気記録層４及び保護層５は図１の磁気記録媒体の一例と同じなので、その説明を省略する。

【００４９】この磁気記録媒体は、接着層（例えば、１ｎｍ厚のＴｉ層）２を介して、基板（例えば、ガラス板）１上に被着形成された、ＮｉＦｅ、ＣｏＺｒ、ＦｅＮ等のいずれかからなる軟磁性層７と、その軟磁性層７上に形成された、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなり、厚さが１ｎｍ以上３０ｎｍ以下の厚さの複合材料層８と、その複合材料層８の上に形成された、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層４とを有する。

【００５０】さて、垂直記録用磁気記録層の下側に、軟磁性層を配すると、記録遷移が明瞭に書けることは知られているが、その反面、磁気記録層のノイズが増加することが多い。そこで、上述のように、軟磁性層７と、積層磁気記録層４との間に、上述の複合材料層８を介挿すると、磁気記録層で発生するノイズを低減することができる。

【００５１】複合材料層８の厚さは、１ｎｍより薄いときは、ノイズ低減効果は得られず、３０ｎｍより厚い場合は、積層磁気記録層４と、軟磁性層７との間の距離が離れ過ぎて、軟磁性層７による上述の効果が小さくなる。

【００５２】図７の例では、軟磁性層７として、例えば、ＮｉＦｅ層を用い、複合材料層８として、例えば、厚さが１０ｎｍの（Ａｕ＋SiO_2）層を用い、積層磁気記録層４として、厚さが、例えば、０．６ｎｍのＰｄ層と、厚さが、例えば、０．６ｎｍのＣｏ層とが、それぞれ２０枚ずつ交互に積層されたものを用いている。

【００５３】次に、図８を参照して、本発明の実施の形態の磁気記録媒体の他の例を説明する。この磁気記録媒体で、基板１、接着層２、下地層３、積層磁気記録層４及び保護層５は図１の磁気記録媒体の一例と同じなので、その説明を省略する。

【００５４】図１の磁気記録媒体において、複合材料からなる下地層３上の積層磁気記録層４が薄いと、保磁力の減少が生じる。

【００５５】この磁気記録媒体は、図１に係る磁気記録媒体において、積層磁気記録層４と、下地層３との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又はその金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層９が介在せしめられてなるものである。この保磁力低下抑制層９の介在によって、積層磁気記録層４が薄い場合の保磁力の低下を抑制することができる。

【００５６】図８の例では、保持力低下抑制層９は、例えば、Ｐｔ層からなる。

【００５７】次に、図９について説明する。それぞれ５枚の、厚さが０．５ｎｍのＰｄ層と、厚さが０．６ｎｍのＣｏ層とを交互に積層して積層磁気記録層４を構成し、Ｐｔが５０％、SiO_2が５０％からなる、厚さが３０ｎｍの（Ｐｔ＋SiO_2）層を用い、積層磁気記録層４及び下地層３間に、Ｐｄからなる保磁力低下抑制層９を挿入し、その他の構成は図８と同様とした磁気記録媒体において、Ｐｄ層の膜厚と、積層磁気記録層４の保磁力（Ｈｃ）（ｋＯｅ）との間の関係を示す特性曲線を、図９に示す。Ｐｄ層の厚みが３～５ｎｍのとき、保磁力（Ｈｃ）がピーク（そのピーク値は、略２．５ｋＯｅ）となる。

【００５８】次に、図１０を参照して、本発明の実施の形態の磁気記録媒体の他の例を説明する。この磁気記録媒体で、基板１、接着層２、下地層３及び保護層５は図６の磁気記録媒体の一例と同じなので、その説明を省略する。

【００５９】図６の磁気記録媒体において、複合材料からなる分断層６によって分割された積層磁気記録層４の各層が薄いと、保磁力の減少が生じる。

【００６０】そこで、この図１０の磁気記録媒体は、図６に係る磁気記録媒体において、積層磁気記録層４の分断層６によって分割された各層と、分断層６との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又はその金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層９が介在せしめられてなるものである。この保磁力低下抑制層９の介在によって、積層磁気記録層４の分断層６によって分割された各層が薄い場合の保磁力の低下を抑制することができる。

【００６１】次に、図１０の磁気記録媒体の例の変形例を説明する。図６の磁気記録媒体において、複合材料からなる下地層３上の積層磁気記録層４が薄いと、保磁力の減少が生じる。

【００６２】図１０の磁気記録媒体の例の変形例は、図示を省略するも、図６に係る磁気記録媒体において、積層磁気記録層中には、保磁力低下抑制層を設けず、積層磁気記録層と、下地層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又はその金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなるものである。この保磁力低下抑制層の介在によって、積層磁気記録層が薄い場合の保磁力の低下を抑制することができる。この場合の保持力低下抑制層も、例えば、Ｐｔ層からなる。

【００６３】次に、図１０の例の他の変形例を説明する。この他の変形例の磁気記録媒体は、図示を省略するも、図１０の磁気記録媒体と同様に、積層磁気記録層の分断層によって分割された各層と、分断層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又はその金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層９が介在せしめられてなると共に、図１０とは異なり、積層磁気記録層と、下地層との間にも、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又はその金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなるものである。この磁気記録媒体によれば、積層磁気記録層内の保磁力低下抑制層の介在によって、積層磁気記録層の分断層によって分割された各層が薄い場合の保磁力の低下を抑制することができると共に、積層磁気記録層と下地層との間の保磁力低下抑制層の介在によって、積層磁気記録層４が薄い場合の保磁力の低下を抑制することができる。

【００６４】次に、図１１を参照して、本発明の実施の形態の磁気記録媒体の他の例を説明する。この磁気記録媒体で、基板１、接着層２、積層磁気記録層４、保護層５及び軟磁性層７は図７の磁気記録媒体の一例と同じなので、その説明を省略する。

【００６５】図７の磁気記録媒体において、複合材料層８上の積層磁気記録層４が薄いと、保磁力の減少が生じる。

【００６６】そこで、図１１の磁気記録媒体は、図７の磁気記録媒体において、積層磁気記録層４と、複合材料層８との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又は該金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層９を介在せしめる。この図１１の磁気記録媒体によれば、この保磁力低下抑制層９の介在によって、積層磁気記録層４が薄くても、保磁力低下を抑制することができる。

【００６７】図１１の例では、積層磁気記録層４と、複合材料層８との間に、保磁力低下抑制層９としての、例えば、Ｐｔ層を介在せしめている。

【００６８】

【実施例】次に、図１２の表図を参照して、本発明の実施の形態の磁気記録媒体の実施例の層構造と、その層構造の磁気記録媒体の保磁力（ｋＯｅ）及びＳ／Ｎ（ｄＢ）とを示す。

【００６９】実施例ａは、図８の類型の磁気記録媒体に属し、Ｃｒを不純物として含む厚さが０．５ｎｍのＣｏ層、即ち、$Co_{85}Cr_{15}$と、厚さが１ｎｍのＰｄ層がそれぞれ３０枚ずつ交互に積層された積層磁気記録層と、体積比でそれぞれ８０％のＡｇ及び２０％のＡｇ及びＭｇＯの複合材料からなる、厚さが１５ｎｍの下地層を有する磁気記録媒体において、積層磁気記録層及び下地層間に、Ｐｄ層からなる、厚さが３ｎｍの保磁力低下抑制層を介在させたもので、保磁力及びＳ／Ｎは、それぞれ２．６ｋＯｅ、２８ｄＢである。

【００７０】実施例ｂは、図１０の類型の変形例の磁気記録媒体に属し、Ｃｒを不純物として含む厚さが０．５ｎｍのＣｏ層、即ち、$Co_{85}Cr_{15}$と、厚さが１ｎｍのＰｄ層がそれぞれ１５枚ずつ交互に積層された積層磁気記録層と、体積比でそれぞれ８０％のＡｇ及び２０％のＡｇ及びＭｇＯの複合材料からなる、厚さが１５ｎｍの下地層とを有する磁気記録媒体いおいて、積層磁気記録層が、体積比でそれぞれ８０％のＡｇ及び２０％のＡｇ及びＭｇＯの複合材料からなる、それぞれ厚さが３ｎｍの、２枚の分断層によって、３分割されると共に、積層磁気記録層及び下地層間に、厚さが３ｎｍのＰｄ層からなる保磁力低下抑制層を介在させたもので、保磁力及びＳ／Ｎはそれぞれ２．２及び３２である。

【００７１】実施例ｃも、図１０の類型の変形例の磁気記録媒体に属し、Ｃｒを不純物として含む厚さが０．５ｎｍのＣｏ層、即ち、$Co_{85}Cr_{15}$と、厚さが１ｎｍのＰｄ層がそれぞれ１０枚ずつ交互に積層された積層磁気記録層と、体積比でそれぞれ８０％のＡｇ及び２０％のＡｇ及びＭｇＯの複合材料からなる、厚さが１５ｎｍの下地層とを有する磁気記録媒体いおいて、積層磁気記録層が、体積比でそれぞれ８０％のＡｇ及び２０％のＡｇ及びＭｇＯの複合材料からなる、それぞれ厚さが３ｎｍの、３枚の分断層によって、４分割されると共に、積層磁気記録層及び下地層間に、厚さが３ｎｍのＰｄ層からなる保磁力低下抑制層を介在させたもので、保磁力及びＳ／Ｎはそれぞれ１．７及び３３である。

【００７２】実施の形態ｄは、図１０の類型の他の変形例の磁気記録媒体に属し、Ｃｒを不純物として含む厚さが０．５ｎｍのＣｏ層、即ち、$Co_{85}Cr_{15}$と、厚さが１ｎｍのＰｄ層がそれぞれ１０枚ずつ交互に積層された積層磁気記録層が、体積比でそれぞれ８０％のＡｇ及び２０％のＡｇ及びＭｇＯの複合材料からなる、３枚の分断層で４層に分断され、積層磁気記録層の３枚の分断層で４層に分割された各層のうちのいずれかと分断層との

間に、Ｐｄ層からなる保磁力低下抑制層を配すると共に、積層磁気記録層と、体積比でそれぞれ８０％のＡｇ及び２０％のＡｇ及びＭｇＯの複合材料からなる下地層との間に、Ｐｄ層からなる厚さが１ｎｍの保磁力低下抑制層が介在せしめられてなるもので、その保磁力及びＳ／Ｎはそれぞれ２．５及び３６である。

【００７３】この図１２の実施例の保磁力及びＳ／Ｎから、図６、図８及び図１０の類型の磁気記録媒体では、積層磁気記録層の分断層による分割数を増やすと、Ｓ／Ｎは改善されるが、保磁力は若干減少する傾向にあるが、Ｐｄ層の如き保磁力低下抑制層を設けることによって、その保磁力低下を抑制することができると共に、Ｓ／Ｎの低下も改善されることが分かる。

【００７４】次に、図１３の表図を参照して、本発明の実施の形態の磁気記録媒体の実施例及びこれと比較すべき従来例の磁気記録媒体の保磁力（ｋＯｅ）及びＳ／Ｎ（ｄＢ）とを示す。

【００７５】従来例は、厚さが０．４ｎｍのＣｏ層及び厚さが０．６ｎｍのＰｄ層をそれぞれ２０枚ずつ交互に重ねた積層磁気記録層の下側に、厚さが２０ｎｍのＰｄ層を積層した磁気記録媒体で、保磁力及びＳ／Ｎがそれぞれ３．４ｋＯｅ、１２ｄＢである。

【００７６】実施例ｅは、図１の類型に属し、厚さが０．６ｎｍのＣｏ層と、厚さが１ｎｍのＰｔ層とが、それぞれ１５枚ずつ積層された積層磁気記録層と、体積比でそれぞれ７０％のＲｈと、３０％のＴｉＮとからなる複合材料の下地層とからなる磁気記録媒体で、その保磁力及びＳ／Ｎはそれぞれ２．２ｋＯｅ、２８ｄＢである。

【００７７】実施例ｆは、図８の類型に属し、厚さが１ｎｍのＣｏと、厚さが０．５ｎｍのＰｔ層とが、それぞれ３０枚ずつ相互に積層された積層磁気記録層と、体積比でそれぞれ６０％のＩｒ及び４０％のＳｉ$_3$Ｎ$_4$の複合材料からなる厚さが４０ｎｍの下地層とを有する磁気記録媒体において、積層磁気記録層及び下地層間に厚さが３ｎｍのＰｄ層からなる保磁力低下抑制層を介在せしめた場合で、保磁力及びＳ／Ｎはそれぞれ１．７、２５である。

【００７８】実施例ｇは、図８の類型に属し、厚さが１ｎｍのＣｏと、厚さが０．５ｎｍのＰｔ層とが、それぞれ１０枚ずつ相互に積層された積層磁気記録層と、体積比でそれぞれ５０％のＰｔ及び５０％のＳｉ$_3$Ｎ$_4$からなる厚さが２０ｎｍの下地層とを有する磁気記録媒体において、積層磁気記録層及び下地層間に厚さが３ｎｍのＰｄ層からなる保磁力低下抑制層を介在せしめた場合で、保磁力及びＳ／Ｎはそれぞれ１．５、３０である。

【００７９】実施例ｈは、図１の類型に属し、厚さが０．６ｎｍのＣｏ層と、厚さが１ｎｍのＰｔ層とがそれぞれ２０枚ずつ積層された積層磁気記録層と、体積比でそれぞれ７０％のＡｕと、３０％のＳｉＣとからなる複合材料の下地層とからなる磁気記録媒体で、その保磁力及びＳ／Ｎはそれぞれ２．３ｋＯｅ、３３ｄＢである。

【００８０】実施例ｉは、図８の類型に属し、不純物Ｎｉを含む厚さが０．７ｎｍのＣｏ層、即ち、$Co_{90}Ni_{10}$層と、厚さが０．８ｎｍのＰｔ層が、それぞれ３０枚ずつ相互に積層された積層磁気記録層と、体積比でそれぞれ７０％のＰｔ層と、３０％のY_2O_3とからなる複合材料からなる厚さが１５ｎｍの下地層からなる磁気記録媒体において、積層磁気記録層及び下地層間に、厚さが３ｎｍのＰｔ層からなる分断層を介挿した場合で、保磁力及びＳ／Ｎはそれぞれ２．０、３０である。

【００８１】実施例ｊは、図１０の類型に属し、厚さが０．６ｎｍのＣｏ層と、厚さが０．５ｎｍのＰｄ層とが交互に積層された積層磁気記録層を有し、その積層磁気記録層が、体積比でそれぞれ９０％のＡｕ及び１０％のＺｒＮからなる厚さが５ｎｍの１枚の分断層によって、２層に分割されると共に、分断層と分割された積層磁気記録層との間に、$Ni_{80}Fe_{11}Ta_9$からなる厚さが２０ｎｍの保磁力低下抑制層を介挿せしめた磁気記録媒体で、Ｓ／Ｎは３２である。

【００８２】

【発明の効果】第１の本発明によれば、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層と、その積層磁気記録層に対する下地層とを有する磁気記録媒体において、下地層は、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなる複合材料層にて構成されてなるので、積層磁気記録層における遷移ノイズが大幅に減少して、短波長記録に好適な磁気記録媒体を得ることができる。

【００８３】第２の本発明によれば、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層を有する磁気記録媒体において、積層磁気記録層は、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなり、厚さが０．３ｎｍ以上１０ｎｍ以下の分断層によって、複数の層に分割されてなるので、積層磁気記録層が厚くても、結晶粒の増大を抑えて、Ｓ／Ｎの劣化を抑制することのできる磁気記録媒体を得ることができる。

【００８４】第３の本発明によれば、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層と、その積層磁

気記録層に対する下地層とを有する磁気記録媒体において、下地層は、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなる複合材料層にて構成されてなると共に、積層磁気記録層は、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなり、厚さが０．３ｎｍ以上１０ｎｍ以下の分断層によって、複数の層に分割されてなるので、積層磁気記録層における遷移ノイズが大幅に減少して、短波長記録に好適になると共に、積層磁気記録層が厚くても、結晶粒の増大を抑えて、Ｓ／Ｎの劣化を抑制することのできる磁気記録媒体を得ることができる。

【００８５】第４の本発明によれば、ＮｉＦｅ、ＣｏＺｒ、ＦｅＮ等のいずれかからなる軟磁性層と、その軟磁性層上に形成された、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ｃｕの面心立法構造の金属のいずれかと、SiO_2、Al_2O_3、ＭｇＯ、TiO_2、Li_2O、ＣａＯ、ＺｎＯ、ＺｒＯ、Y_2O_3、ＨｆＯ等の酸化物のいずれか（又はSi_3N_4、ＡｌＮ、ＢＮ、Ｔｉｎ、ＺｒＮ、ＧａＮ等の窒化物のいずれか）（又はＳｉＣ、ＴｉＣ、ＺｒＣ、ＴａＣ等の炭化物のいずれか）との複合材料からなり、厚さが１ｎｍ以上３０ｎｍ以下の厚さの複合材料層と、その複合材料層の上に形成された、Ｐｔ層（又はＰｄ層）及びＣｏ層からなる積層磁気記録層とを有するので、記録遷移が明瞭に書けると共に、その軟磁性層の存在によって積層磁気記録層におけるノイズの増加を抑制することのできる磁気記録媒体を得ることができる。

【００８６】第５の本発明によれば、第１の本発明において、積層磁気記録層と、下地層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又はその金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなるので、積層磁気記録層における遷移ノイズが大幅に減少して、短波長記録に好適になると共に、積層磁気記録層が薄くても、保磁力の低下を抑制することのできる磁気記録媒体を得ることができる。

【００８７】第６の本発明によれば、第２の本発明において、積層磁気記録層の分断層によって分割された各層と、分断層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又はその金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなるので、積層磁気記録層が厚くても、結晶粒の増大を抑えて、Ｓ／Ｎの劣化を抑制することができると共に、積層磁気記録層の分断層によって分割された各層が薄くなっても、保磁力の低下を抑制することのできる磁気記録媒体を得ることができる。

【００８８】第７の本発明によれば、第３の本発明において、積層磁気記録層の分断層によって分割された各層と、分断層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又はその金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなるので、積層磁気記録層における遷移ノイズが大幅に減少して、短波長記録に好適になり、積層磁気記録層が厚くても、結晶粒の増大を抑えて、Ｓ／Ｎの劣化を抑制することができると共に、積層磁気記録層の分断層によって分割された各層が薄くなっても、保磁力の低下を抑制することのできる磁気記録媒体を得ることができる。

【００８９】第８の本発明によれば、第３の本発明において、積層磁気記録層と、下地層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又はその金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなるので、積層磁気記録層における遷移ノイズが大幅に減少して、短波長記録に好適になり、積層磁気記録層が厚くても、結晶粒の増大を抑えて、Ｓ／Ｎの劣化を抑制することができると共に、積層磁気記録層が薄くても、保磁力の低下を抑制することのできる磁気記録媒体を得ることができる。

【００９０】第９の本発明によれば、第４の本発明において、積層磁気記録層と、複合材料層との間に、Ｐｔ、Ａｕ、Ｐｄ、Ａｇ、Ｒｈ、Ｉｒ、Ａｌ、Ｎｉ、Ｃｕ等の面心立法構造の金属のいずれか（又はその金属の合金のいずれか）からなり、０．３ｎｍ以上５ｎｍ以下の厚さの保磁力低下抑制層が介在せしめられてなるので、記録遷移が明瞭に書けると共に、その軟磁性層の存在によって積層磁気記録層におけるノイズの増加を抑制することができ、且つ、積層磁気記録層が薄くても、保磁力の低下を抑制することのできる磁気記録媒体を得ることができる。

【００９１】第１０の本発明によれば、第２の本発明において、積層磁気記録層の複合材料層によって分割された各層の厚さが、３ｎｍ以上２０ｎｍ以下に設定されてなるので、積層磁気記録層が厚くても、結晶粒の増大を抑えて、Ｓ／Ｎの劣化を抑制することのできると共に、十分な保磁力が得られ、且つ、十分なノイズ低減効果の

得られる磁気記録媒体を得ることができる。

【００９２】第１１の本発明によれば、第３の本発明において、積層磁気記録層の複合材料層によって分割された各層の厚さが、３ｎｍ以上２０ｎｍ以下に設定されてなるので、積層磁気記録層における遷移ノイズが大幅に減少して、短波長記録に好適となり、積層磁気記録層が厚くても、結晶粒の増大を抑えて、Ｓ／Ｎの劣化を抑制することができると共に、十分な保磁力が得られ、且つ、十分なノイズ低減効果の得られる磁気記録媒体を得ることができる。

【図面の簡単な説明】

【図１】本発明の実施の形態の磁気記録媒体の一例を示す断面図である。

【図２】実施の形態の磁気記録媒体の一例（図１）の磁化曲線である。

【図３】実施の形態の磁気記録媒体の一例（図１）の再生スペクトルである。

【図４】実施の形態の磁気記録媒体の一例（図１）のターゲットのＡｕの被覆率と膜中のＡｕの体積比との間の関係を示す特性曲線である。

【図５】実施の形態の磁気記録媒体の一例（図１）のＰｔの体積比と、保磁力（Ｈｃ）及びＳ／Ｎととの間の関係を示す特性曲線である。

【図６】実施の形態の磁気記録媒体の他の例を示す断面図である。

＊【図７】実施の形態の磁気記録媒体の更に他の例を示す断面図である。

【図８】実施の形態の磁気記録媒体の更に他の例を示す断面図である。

【図９】実施の形態の磁気記録媒体の更に他の例（図８）におけるＰｄ層の膜厚と、保磁力（Ｈｃ）との間の関係を示す特性曲線である。

【図１０】実施の形態の磁気記録媒体の更に他の例を示す断面図である。

【図１１】実施の形態の磁気記録媒体の更に他の例を示す断面図である。

【図１２】実施の形態の磁気記録媒体の各実施例の保磁力及びＳ／Ｎを示す表図である。

【図１３】実施の形態の磁気記録媒体の各実施例と、これらと比較すべき従来例との保磁力及びＳ／Ｎを示す表図である。

【図１４】従来の磁気記録媒体の断面図である。

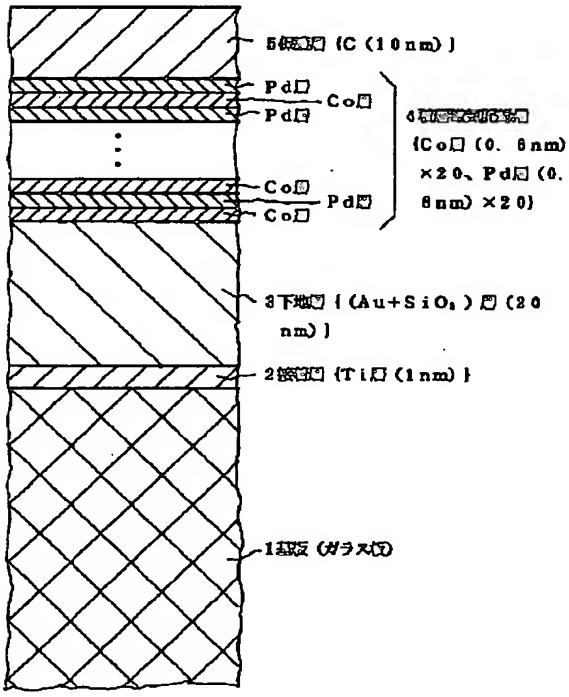
【図１５】従来の磁気記録媒体（図１４）の磁化曲線である。

【図１６】従来の磁気記録媒体（図１４）の再生スペクトルである。

【符号の説明】

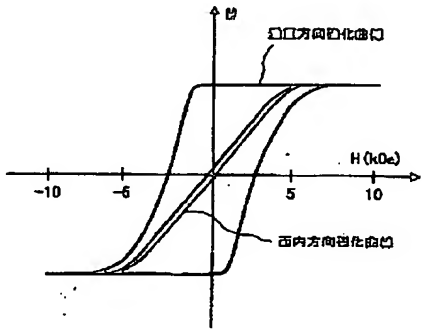
１　基板、２　接着層、３　下地層、４　積層磁気記録層、５　保護層、６分断層、７　軟磁性層、８　複合材料層、９　保磁力低下抑制層。

【図１】



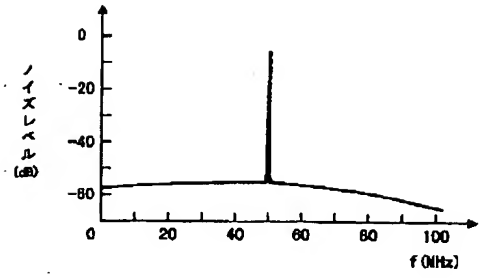
磁気記録媒体の例

【図２】



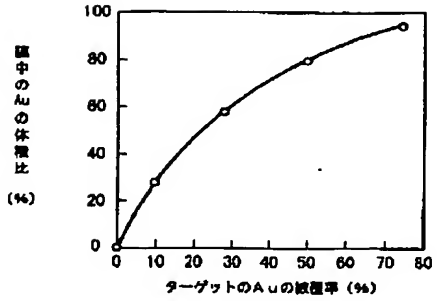
実施の形態の媒体の磁化曲線

【図３】



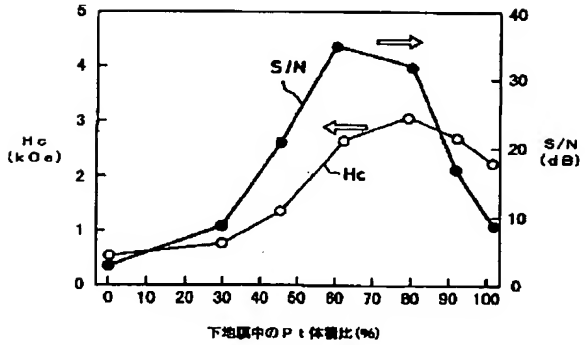
実施の形態の媒体の再生スペクトル

【図４】



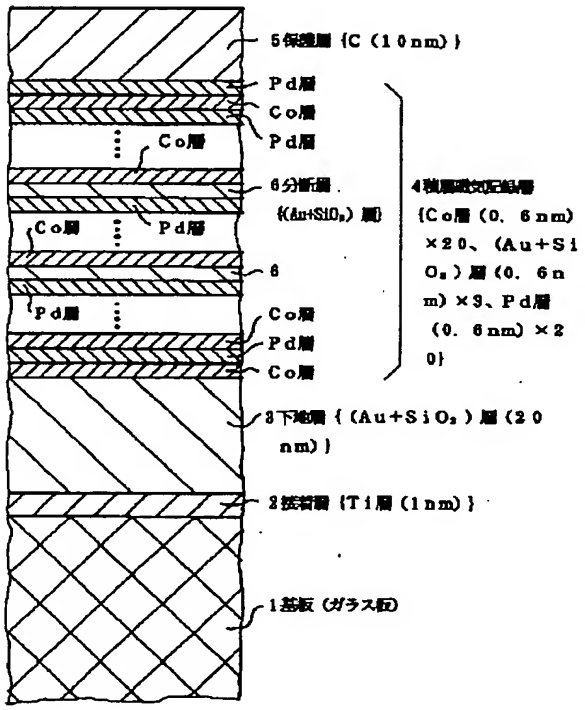
特　性　曲　線

【図５】



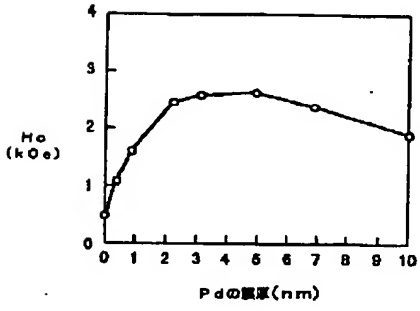
特　性　曲　線

【図６】



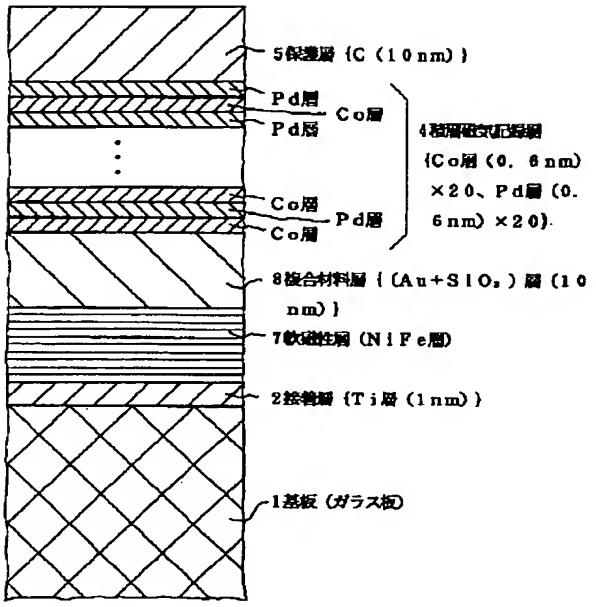
磁気記録媒体の例

【図９】



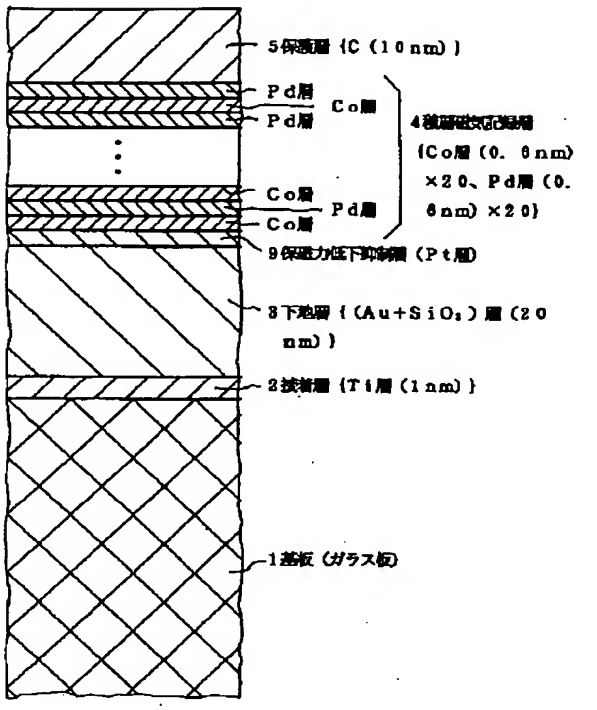
特性曲線

【図７】



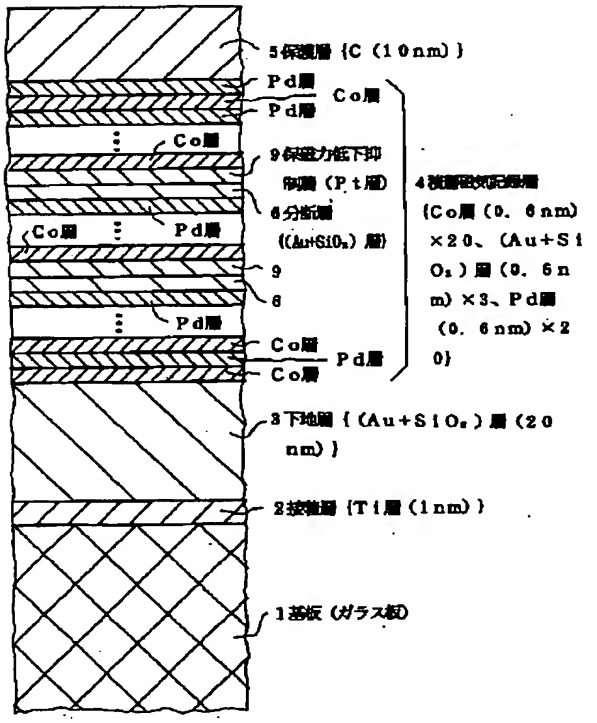
磁気記録媒体の例

【図８】



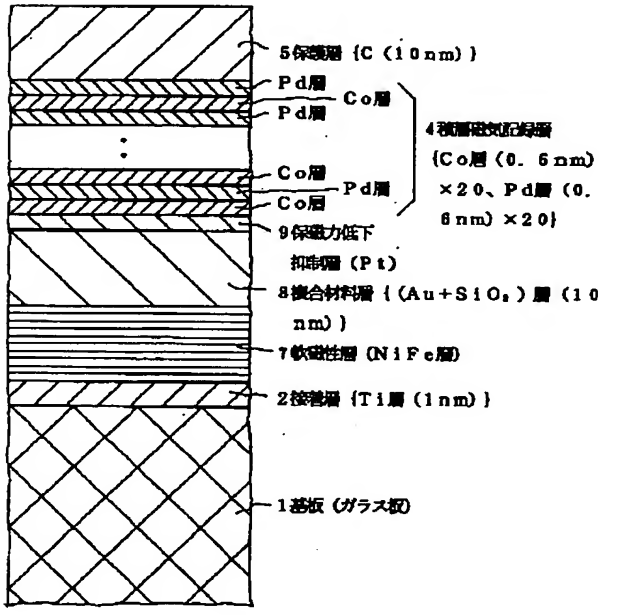
磁気記録媒体の例

【図１０】



磁気記録媒体の例

【図１１】



磁気記録媒体の例

【図１２】

実施例の図面記号	磁気記録媒体の層構成	保磁力 (kOe)	S／N (dB)
実施例a	($Co_{88}Cr_{12}$:0.5nm／Pd:1nm) ×30／Pd:3nm／(80% Ag+20% MgO):15nm	2．6	28
実施例b	[($Co_{88}Cr_{12}$:0.5nm／Pd:1nm) ×15／(80% Ag+20% MgO):3nm] ×2／Pd:8nm／(80% Ag+20% MgO):15nm	2．2	32
実施例c	[($Co_{88}Cr_{12}$:0.5nm／Pd:1nm) ×10／(80% Ag+20% MgO):2nm]×3／Pd:8nm／(80% Ag+20% MgO):15nm	1．7	33
実施例d	[($Co_{88}Cr_{12}$:0.5nm／Pd:1nm) ×10／Pd:1nm／(80%Ag+20% MgO):3nm]×3／Pd:8nm／(80%Ag+20% MgO):15nm	2．5	36

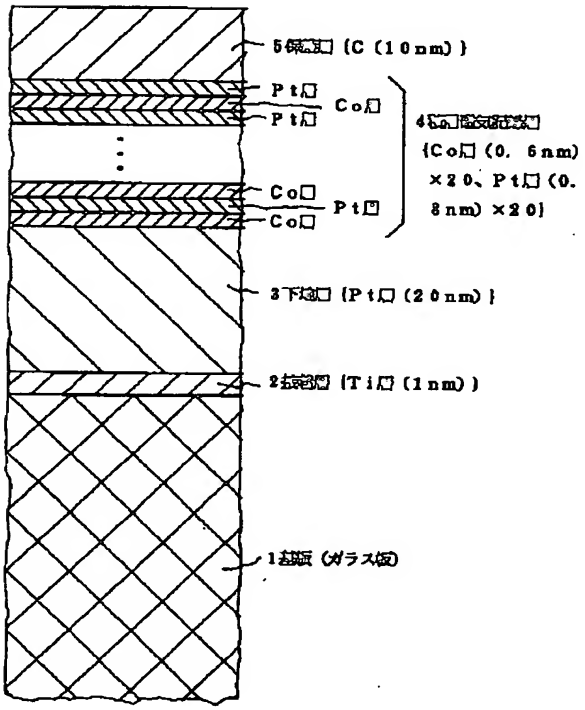
実施例の保磁力及びS／N

【図１３】

従来例と実施例の説明記号	磁気記録媒体の層構成	保磁力 (kOe)	S／N (dB)
従来例	(Co:0.4nm／Pd:0.6nm) ×20／Pd:20nm	3．4	12
実施例e	(Co:0.6nm／Pt:1nm) ×15／(70% Rh+30% TiN):20nm	2．2	28
実施例f	($Co_{88}Cr_{12}$:0.5nm／Pt:0.8nm) ×30／Pt:2nm／(60% Ir+40% BN):40nm	1．7	25
実施例g	(Co:1nm／Pd:0.5nm) ×10／Pd:3nm／(50% Pt+50% Si_3N_4):20nm	1．5	30
実施例h	(Co:0.6nm／Pt:1nm) ×20／(70% Au+30% SiC):30nm	2．3	33
実施例i	($Co_{88}Ni_{12}$:0.7nm／Pt:0.8nm) ×30／Pt:3nm／(70%Pt+30% Y_2O_3):15nm Y_2O_3):15nm	2．0	30
実施例j	(Co:0.8nm／Pd:0.6nm) ×20／(90% Au+10% ZrN):5nm／$Ni_{80}Fe_{12}Ta_8$:20nm	——	32

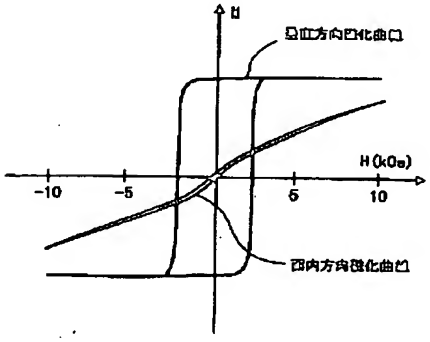
従来例と実施例の保磁力及びS／Nの比較

【図１４】



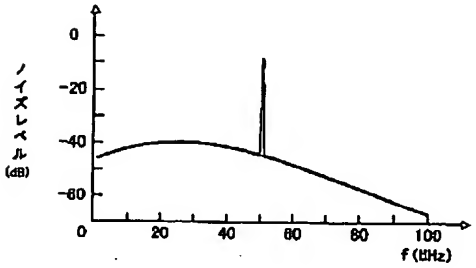
従来の磁気記録媒体

【図１５】



従来の媒体の磁化曲線

【図１６】



従来の媒体の再生スペクトル

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-155329
(43)Date of publication of application : 08.06.2001

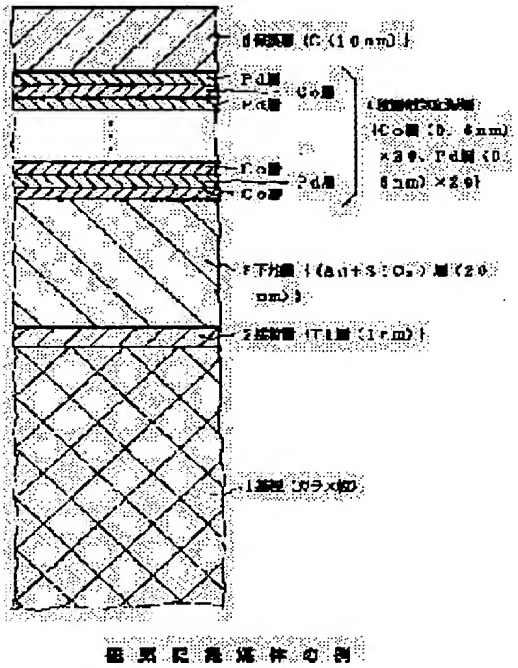
(51)Int.Cl. G11B 5/738
G11B 5/673

(21)Application number : 11-340277
(22)Date of filing : 30.11.1999

(71)Applicant : SONY CORP
(72)Inventor : OMORI HIROYUKI

(54) MAGNETIC RECORDING MEDIUM

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a magnetic recording medium suitable for short wavelength recording by providing a layered magnetic recording layer formed by stacking Co and Pt or Pd alternately to reduce transition noise remarkably in the layered magnetic recording layer.
SOLUTION: This magnetic recording medium has the layered magnetic recording layer 4 consisting of the Pt layer (or Pd layer) and the Co layer and an under layer 3 of the layer 4. The layer 3 is constituted of a composite material layer comprising a composite material consisting of any of metals each having a face-centered cubic structure such as Pt, Au, Pd, Ag, Ir and Cu and any of oxides such as SiO2, Al2O3, MgO, TiO2, LiO2 CaO, ZnO, ZrO, Y2O3 and HfO (or any of nitrides such as Si3N4, AlN, BN, TiN, ZrN and GaN) (or any of carbides such as SiC, TiC, ZrC and TaC).



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

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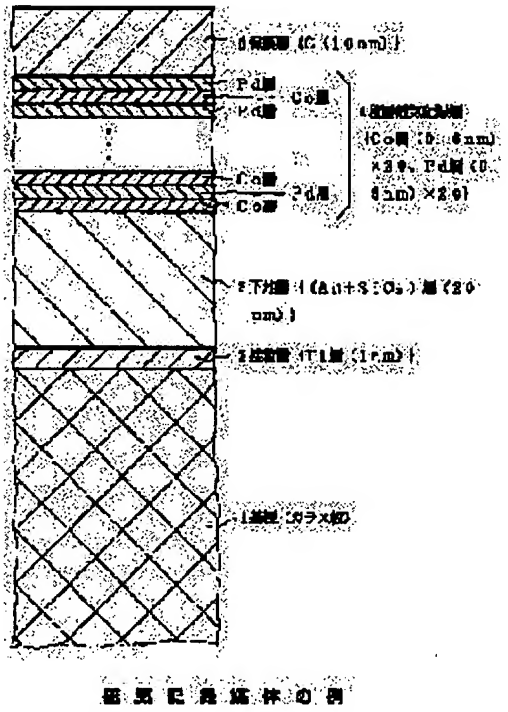

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[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

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[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] A laminating magnetic-recording layer which consists of a Pt layer (or Pd layer) and a Co layer A substrate layer to this laminating magnetic-recording layer It is magnetic-recording data medium equipped with the above. The above-mentioned substrate layer Either of the metals of face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) It is characterized by coming to consist of composite-material layers which consist of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN.
[Claim 2] In magnetic-recording data medium which has a laminating magnetic-recording layer which consists of a Pt layer (or Pd layer) and a Co layer the above-mentioned laminating magnetic-recording layer Either of the metals of face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) It consists of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN. Thickness by 0.3nm or more fragmentation layer 10nm or less Magnetic-recording data medium characterized by coming to be divided into two or more layers.
[Claim 3] A laminating magnetic-recording layer which consists of a Pt layer (or Pd layer) and a Co layer A substrate layer to this laminating magnetic-recording layer It is magnetic-recording data medium equipped with the above. The above-mentioned substrate layer Either of the metals of face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) While consisting of composite-material layers which consist of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN The above-mentioned laminating magnetic-recording layer Either of the metals of face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2O3, and HfO, (or Si3 N4 --) It consists of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN, and thickness is characterized by coming to be divided into two or more layers by 0.3nm or more fragmentation layer 10nm or less.
[Claim 4] Magnetic-recording data medium characterized by providing the following. A soft magnetism layer which consists of NiFe, CoZr, or FeN Either of the metals of face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu formed on this soft magnetism layer SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) It consists of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN, and thickness is a with a 1nm or more thickness [thickness 30nm or less] composite-material layer. A laminating magnetic-recording layer which consists of Pt layer (or Pd layer) and Co layer which were formed on this composite-material layer
[Claim 5] Magnetic-recording data medium characterized by consisting of either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of this metal) between the above-mentioned laminating magnetic-recording layer and the above-mentioned substrate layer, and making a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer come to intervene in magnetic-recording data medium according to claim 1.
[Claim 6] In magnetic-recording data medium according to claim 2, between each class divided by the above-mentioned part fault of the above-mentioned laminating magnetic-recording layer, and the above-mentioned part fault Magnetic-recording data medium characterized by consisting of either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of this metal), and making a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer come to intervene.
[Claim 7] In magnetic-recording data medium according to claim 3, between each class divided by the above-mentioned

part fault of the above-mentioned laminating magnetic-recording layer, and the above-mentioned part fault Magnetic-recording data medium characterized by consisting of either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of this metal), and making a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer come to intervene.

[Claim 8] Magnetic-recording data medium characterized by consisting of either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of this metal) between the above-mentioned laminating magnetic-recording layer and the above-mentioned substrate layer, and making a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer come to intervene in magnetic-recording data medium according to claim 3.

[Claim 9] Magnetic-recording data medium characterized by consisting of either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of this metal) between the above-mentioned laminating magnetic-recording layer and the above-mentioned composite-material layer, and making a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer come to intervene in magnetic-recording data medium according to claim 4.

[Claim 10] Magnetic-recording data medium by which thickness of each class divided by the above-mentioned part fault of the above-mentioned laminating magnetic-recording layer is characterized by coming to be set as 3nm or more 20nm or less in magnetic-recording data medium according to claim 2.

[Claim 11] Magnetic-recording data medium by which thickness of each class divided by the above-mentioned part fault of the above-mentioned laminating magnetic-recording layer is characterized by coming to be set as 3nm or more 20nm or less in magnetic-recording data medium according to claim 3.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention is applied to a hard disk, a magnetic tape, a floppy disk, a magneto-optic disk, etc., and relates to suitable magnetic-recording data medium.
[0002]
[Description of the Prior Art] The heat demagnetization to which record magnetization decreases the magnetic recording within a field to magnetic-recording data medium in connection with the densification of recording information according to the passage of time is posing a problem.
[0003] There is a vertical magnetic recording as one of the technique of solving the trouble of the magnetic recording within a field over this magnetic-recording data medium. As a magnetic material of this magnetic-recording data medium for vertical magnetic recordings, the CoCr alloy is studied widely.
[0004] However, since the vertical magnetic anisotropy of the CoCr alloy as a magnetic material of magnetic-recording data medium for vertical magnetic recordings is smaller than saturation magnetization, it has the defect that a vertical remanence ratio is not set to 1. For this reason, a reversal magnetization field generates the magnetic layer of a CoCr alloy in a long wavelength record portion, and it is known that it will cause a noise.
[0005] In order to solve this problem, as such a magnetic layer, there is a laminating magnetic layer which carried out the laminating of Co, Pt, or the Pd by turns that what is necessary is just to use the big material of a vertical magnetic anisotropy as a magnetic layer of magnetic-recording data medium for vertical magnetic recordings.
[0006] Conventional magnetic-recording data medium which used as the record layer the laminating magnetic layer which carried out the laminating of this Co, Pt, or Pd to below by turns with reference to drawing 14 is explained. 1 is a substrate, and although the construction material of this differs according to the class of magnetic-recording data medium, it is glass plates here, for example. On the substrate 1, covering formation of the substrate layer 3 which thickness becomes from Pt layer which is 20nm is carried out through the glue line 2 which thickness becomes from Ti layer which is 1nm. On the substrate layer 3, covering formation of the laminating magnetic-recording layer 4 to which the laminating of Co layer whose thickness is 0.6nm, and the Pt layer whose thickness is 0.8nm was carried out 20 sheets at a time by turns, respectively is carried out. On the laminating magnetic-recording layer 4, covering formation of the protective layer 5 which thickness becomes from C which is 10nm is carried out.
[0007] The conventional field inboard and the conventional perpendicular direction magnetization curve of magnetic-recording data medium which were illustrated to drawing 15 at drawing 14 are shown. In drawing 15 , a horizontal axis shows intensity-of-magnetization H (kOe), and an axis of ordinate shows Magnetization M. The playback spectrum when recording and reproducing the signal of constant frequency by the magnetic-recording data medium in conventional magnetic-recording data medium illustrated to drawing 16 at drawing 14 is shown. In drawing 16 , a horizontal axis shows f (frequency) (MHz) and an axis of ordinate shows a noise level (dB). In addition, about assessment of the property of drawing 15 and drawing 16 , it mentions later.
[0008]
[Problem(s) to be Solved by the Invention] By the way, since there is little generating of the noise in a laminating magnetic-recording layer since magnetic-recording data medium which has the laminating magnetic-recording layer which carried out the laminating of this Co, Pt, or Pd by turns has enough the vertical magnetic anisotropy of a laminating magnetic-recording layer larger than saturation magnetization, but on the other hand there are many transition noises, it is unsuitable for short wavelength record.
[0009] In view of this point, in magnetic-recording data medium which has the laminating magnetic-recording layer which carried out the laminating of Co, Pt, or the Pd by turns, the transition noise in a laminating magnetic-recording

layer tends to decrease substantially, and this invention tends to propose the suitable thing for short wavelength record.
[0010] By the way, when a laminating magnetic-recording layer becomes thick, the noise of conventional magnetic-recording data medium which has the laminating magnetic-recording layer which carried out the laminating of this Co, Pt, or Pd by turns increases according to buildup of crystal grain beyond the increment in an output, and it has the defect that S/N deteriorates.
[0011] In magnetic-recording data medium which has the laminating magnetic-recording layer to which this invention carried out the laminating of Co, Pt, or the Pd by turns in view of this point, even if a laminating magnetic-recording layer is thick, buildup of crystal grain tends to be suppressed and it is going to propose what can control deterioration of S/N.
[0012] Moreover, in magnetic-recording data medium which has the laminating magnetic-recording layer which carried out the laminating of Co, Pt, or the Pd by turns, a transition noise decreases substantially, and while this invention is suitable for short wavelength record, even if a laminating magnetic-recording layer is thick, it tends to suppress buildup of crystal grain and tends to propose what can control deterioration of S/N.
[0013] By the way, in magnetic-recording data medium which has the laminating magnetic-recording layer which carried out the laminating of Co, Pt, or the Pd by turns, when the soft magnetism layer was prepared in the bottom of the laminating magnetic-recording layer, record transition can be written clearly, but on the other hand it turned out that the noise in a laminating magnetic-recording layer increases in many cases. Here, it means that, as for the ability "to write record transition clearly", crystal grain becomes small, and the magnetic interaction between grains becomes small, and a blot of record transition decreases.
[0014] In magnetic-recording data medium which has the laminating magnetic-recording layer to which this invention carried out the laminating of Co, Pt, or the Pd by turns in view of this point, while being able to write record transition clearly by preparing a soft magnetism layer in the bottom of a laminating magnetic-recording layer, it is going to propose what can control the increment in the noise in a laminating magnetic-recording layer by existence of the soft magnetism layer.
[0015] By the way, Co, Pt, or Pd is set to magnetic-recording data medium by which the laminating magnetic-recording layer which carried out the laminating by turns was prepared. As a substrate layer to the laminating magnetic-recording layer, either of the metals of the face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) If one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN, is prepared Although this invention person found out that the transition noise in a laminating magnetic-recording layer decreased substantially, and suitable magnetic-recording data medium for short wavelength record was obtained as a result of research, when the laminating magnetic-recording layer was thin, it turned out that coercive force declines.
[0016] The laminating magnetic-recording layer which this invention becomes from Pt layer (or Pd layer) and Co layer in view of this point, It is magnetic-recording data medium which has a substrate layer to the laminating magnetic-recording layer. As the substrate layer Either of the metals of the face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) In magnetic-recording data medium which prepared one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN Even if a laminating magnetic-recording layer is thin, it is going to propose what can control lowering of coercive force.
[0017] By the way, the laminating magnetic-recording layer which consists of a Pt layer (or Pd layer) and a Co layer, It is magnetic-recording data medium which has a substrate layer to the laminating magnetic-recording layer. As the substrate layer Either of the metals of the face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) Either of the nitrides, such as AlN, BN, Tin, ZrN, and GaN, (or it SiC(s)) One composite material of carbide, such as TiC, ZrC, and TaC, is prepared. Thickness by 0.3nm or more fragmentation layer 10nm or less [a laminating magnetic-recording layer] Even if the laminating magnetic-recording layer was thick, magnetic-recording data medium which it comes to divide into two or more layers could suppress buildup of crystal grain, and could control deterioration of S/N, but when each class divided by the fragmentation layer of a laminating magnetic-recording layer was thin, it turned out that coercive force declines.
[0018] In magnetic-recording data medium which has the laminating magnetic-recording layer to which this invention carried out the laminating of Co, Pt, or the Pd by turns in view of this point, even if a laminating magnetic-recording layer is thick, while being able to suppress buildup of crystal grain and being able to control deterioration of S/N, even if each class divided by the fragmentation layer of a laminating magnetic-recording layer is thin, it is going to propose that to which coercive force does not fall.

[0019] By the way, the laminating magnetic-recording layer which consists of a Pt layer (or Pd layer) and a Co layer, It is magnetic-recording data medium which has a substrate layer to the laminating magnetic-recording layer. The laminating magnetic-recording layer Either of the metals of the face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) It consists of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN. Thickness by 0.3nm or more fragmentation layer 10nm or less Although magnetic-recording data medium which it comes to divide into two or more layers can suppress buildup of crystal grain and can control deterioration of S/N even if a laminating magnetic-recording layer is thick On the other hand, if the thickness of each class divided by the fragmentation layer of a laminating magnetic-recording layer is smaller than 3nm, sufficient coercive force will not be acquired, and if larger than 20nm, sufficient noise reduction effect will not be acquired.

[0020] In magnetic-recording data medium which has the laminating magnetic-recording layer which this invention becomes from Pt layer (or Pd layer) and Co layer in view of this point, even if a laminating magnetic-recording layer is thick, while being able to suppress buildup of crystal grain and being able to control deterioration of S/N, it is going to propose that from which sufficient coercive force is acquired and sufficient noise reduction effect is acquired.

[0021]

[Means for Solving the Problem] In magnetic-recording data medium which has a laminating magnetic-recording layer which the 1st this invention becomes from Pt layer (or Pd layer) and Co layer, and a substrate layer to the laminating magnetic-recording layer a substrate layer Either of the metals of face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) It is magnetic-recording data medium which it comes to consist of composite-material layers which consist of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN.

[0022] According to this 1st this invention, a substrate layer to a laminating magnetic-recording layer which consists of a Pt layer (or Pd layer) and a Co layer Either of the metals of face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) Since it consists of composite-material layers which consist of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN, a transition noise in a laminating magnetic-recording layer decreases substantially.

[0023] In magnetic-recording data medium which has a laminating magnetic-recording layer which the 2nd this invention becomes from Pt layer (or Pd layer) and Co layer a laminating magnetic-recording layer Either of the metals of face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) It consists of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN, and thickness is magnetic-recording data medium which it comes to divide into two or more layers by 0.3nm or more fragmentation layer 10nm or less.

[0024] In magnetic-recording data medium which has a laminating magnetic-recording layer which the 3rd this invention becomes from Pt layer (or Pd layer) and Co layer, and a substrate layer to the laminating magnetic-recording layer a substrate layer Either of the metals of face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) While consisting of composite-material layers which consist of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN A laminating magnetic-recording layer Either of the metals of face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) It consists of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN, and thickness is magnetic-recording data medium which it comes to divide into two or more layers by 0.3nm or more fragmentation layer 10nm or less.

[0025] A soft magnetism layer which the 4th this invention becomes from NiFe, CoZr, or FeN, Either of the metals of face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu formed on the soft magnetism layer, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) It consists of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN. Thickness A with a 1nm or more thickness [thickness 30nm or less] composite-material layer, It is magnetic-recording data medium which has a laminating magnetic-recording layer which consists of Pt layer (or Pd layer) and Co layer which were formed on the composite-material layer.

[0026] The 5th this invention is magnetic-recording data medium between which become from either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of the metal) between a laminating magnetic-recording layer and a substrate layer, and a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer is made to come to be placed in the 1st this invention.
[0027] In the 2nd this invention, the 6th this invention between each class divided by fragmentation layer of a laminating magnetic-recording layer, and a fragmentation layer It is magnetic-recording data medium between which become from either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of the metal), and a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer is made to come to be placed.
[0028] In the 3rd this invention, the 7th this invention between each class divided by fragmentation layer of a laminating magnetic-recording layer, and a fragmentation layer It is magnetic-recording data medium between which become from either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of the metal), and a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer is made to come to be placed.
[0029] The 8th this invention is magnetic-recording data medium between which become from either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of the metal) between a laminating magnetic-recording layer and a substrate layer, and a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer is made to come to be placed in the 3rd this invention.
[0030] The 9th this invention is magnetic-recording data medium between which become from either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of the metal) between a laminating magnetic-recording layer and a composite-material layer, and a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer is made to come to be placed in the 4th this invention.
[0031] The 10th and 11th this inventions are magnetic-recording data medium by which it comes to set thickness of each class divided by composite-material layer of a laminating magnetic-recording layer as 3nm or more 20nm or less in the 2nd and 3rd this inventions, respectively.
[0032]
[Embodiment of the Invention] First, with reference to drawing 1 , an example of magnetic-recording data medium of the gestalt of operation of this invention is explained. 1 is a substrate, and although the construction material of this differs according to the class of magnetic-recording data medium, it is glass plates here, for example. On a substrate 1, covering formation of the substrate layer 2 is carried out through a glue line 2. When a substrate 1 is a glass plate, as a glue line 2, Ti is used and the thickness is 1nm, for example.
[0033] And covering formation of the laminating magnetic-recording layer 4 which consists of a Pt layer (or Pd layer) and a Co layer on the substrate layer 3 is carried out. Here, as for this laminating magnetic-recording layer 4, the laminating of the 0.6nm Co layer is carried out [thickness] at a time for 20 thickness to 0.6nm Pd layer by turns, respectively.
[0034] On the laminating magnetic-recording layer 4, covering formation of the protective layer 5 is carried out. This protective layer 5 consists of C of 10nm thickness here, for example.
[0035] The above-mentioned substrate layer 2 Either of the metals of the face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, It consists of composite-material layers which consist of one (or either of the nitrides, such as Si3N4, and AlN, BN, Tin, ZrN, GaN) (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the oxides, such as ZnO, ZrO, Y2 O3, and HfO. By having the presentation which requires the substrate layer 2, the transition noise looked at by magnetic-recording data medium which consists of a Pt layer (or Pd layer) and a Co layer, and which it has laminating magnetic-recording layer 4 can be decreased greatly. Here, the substrate layer 2 is Au and SiO2. Consisting of a composite-material layer which consists of composite material, the thickness is 20nm.
[0036] The material which cannot receive chemical change of oxidation, nitriding, etc. easily is chosen, and especially Pt, Au, Pd, Ag, Rh, Ir, and Cu that are the metal of above-mentioned face-centered legislation structure used for the substrate layer 2 are possible also for an alloy. Above-mentioned SiO2 used for the substrate layer 2, aluminum 2O3, MgO, and TiO2, either of the oxides, such as Li2 O, CaO, ZnO and ZrO, Y2 O3, and HfO, (or Si3 N4 --) Either of the nitrides, such as AlN, BN, Tin, ZrN, and GaN, (or either of carbide, such as SiC, TiC, ZrC, and TaC) consists of a compound with the element which is easy to combine with oxygen, such as Si, aluminum, and Ti, or nitrogen, oxygen and nitrogen, carbon, etc.
[0037] The field inboard and the perpendicular direction magnetization curve of magnetic-recording data medium of

operation of drawing 1 are shown in drawing 2 . [of a gestalt] In drawing 2 , a horizontal axis shows intensity-of-magnetization H (kOe), and an axis of ordinate shows Magnetization M. Since the inclination (dM/dH) of the field inboard magnetization curve of drawing 2 is steep compared with the inclination (dM/dH) of the field inboard magnetization curve of drawing 15 , magnetic-recording data medium with few [there are few interactions between magnetic particles and] noises which are contained in a regenerative signal for this reason is obtained.

[0038] Drawing 3 shows the playback spectrum when recording and reproducing the signal of constant frequency to an example of magnetic-recording data medium of drawing 1 . In drawing 3 , a horizontal axis shows f (frequency) (MHz) and an axis of ordinate shows a noise level (dB).

[0039] Drawing 3 and the playback spectrum of drawing 16 on the glass disk whose diameter is 2.5 inches Relative velocity [as opposed to / form drawing 1 and magnetic-recording data medium of drawing 14 , respectively, and / the magnetic head for the disk] is 15 m/sec. It is made to rotate so that it may become. The signal whose frequency is 50MHz is recorded on formed magnetic-recording data medium by the MR head (magnetoresistive head) whose recording track width of face is 1.2 micrometers, and regenerative-track width of face reproduces and measures the record signal by the MR head which is 0.9 micrometers. When playback SUPEKURU of drawing 3 and drawing 16 is compared, it turns out that the noise level of drawing 3 is lower than drawing 16 .

[0040] The rate of a coat of Au of the target of the substrate layer 3 of magnetic-recording data medium of drawing 1 (%) and the relation between Au ******** (%) contained in a film were illustrated as a characteristic curve to drawing 4 . Au and SiO2 which constitute the substrate layer 3 in the case of this measurement A volume ratio is Au:60% and SiO2. : It was 40%.

[0041] While changing the thickness of Co layer in the laminating magnetic-recording layer 4 in magnetic-recording data medium in drawing 1 into 0.5nm from 0.6nm and changing into drawing 5 Pd layer whose thickness is 0.8nm at Pt layer whose thickness is 1nm From the layer whose thickness is 20nm (Au+aluminum 2O3), when the substrate layer 3 is changed into the layer whose thickness is 20nm (Pt+aluminum 2O3), it can be set. The relation between the ratios (S/N) (dB) of the vertical coercive force Hc (kOe) and the signal pair noise to the volume ratio (%) of Pt in the substrate layer 3 is shown as a characteristic curve. In this case, magnetic-recording data medium is formed on the glass disk whose radius is 2.5 inches, respectively. Relative velocity [as opposed to the magnetic head for the disk] is 15 m/sec. It is made to rotate so that it may become. The signal whose frequency is 50MHz by the MR head (magnetoresistive head) whose recording track width of face is 1.2 micrometers It recorded on formed magnetic-recording data medium, regenerative-track width of face reproduced the record signal with 0.9micromMR arm head, and the ratio of the 50MHz signal in the regenerative signal and the noise reinforcement which integrated with the noise from 0MHz to 80MHz was made into S/N.

[0042] Next, with reference to drawing 6 , other examples of magnetic-recording data medium of the gestalt of operation of this invention are explained. By this magnetic-recording data medium, since a substrate 1, a glue line 2, the substrate layer 3, and a protective layer 5 are the same as an example of magnetic-recording data medium of drawing 1 , that explanation is omitted and the laminating magnetic-recording layer 4 is explained.

[0043] By the way, by **** magnetic-recording data medium shown in drawing 1 , if the laminating magnetic recording 4 becomes thick, according to buildup of crystal grain, a noise will increase beyond the increment in an output and a signal-noise ratio (S/N) will deteriorate.

[0044] Then, the laminating magnetic-recording layer 4 of this magnetic-recording data medium The laminating magnetic-recording layer which consists of a Pt layer (or Pd layer) and a Co layer Either of the metals of the face-centered legislation structure of Pt, Au, Pd, Ag, Rh, and Ir, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) It consists of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN, and thickness is divided and constituted by two or more layers by the 0.3nm or more fragmentation layer 6 10nm or less.

[0045] By constituting the laminating magnetic-recording layer 4 in this way, the grain growth in the laminating magnetic-recording layer which consists of a Pt layer (or Pd layer) and a Co layer by the fragmentation layer 6 is stopped, and even if the laminating magnetic-recording layer is thick, the increment in a noise is suppressed.

[0046] When the thickness of the fragmentation layer 6 is thinner than 0.3nm, sufficient noise reduction effect is not acquired, and when thicker than 10nm, the thickness of the laminating magnetic-recording layer 4 becomes thick too much, and it becomes impossible to perform record sufficient at the time of high density record.

[0047] Thickness in the example of drawing 6 for example, Pd layer whose thickness is 0.6nm and thickness For example, the laminating magnetic-recording layer which consists of 30 sets of layers which 0.6nm Co layer turns into from Pd layer and Co layer by which the laminating was carried out by turns 20 sheets at a time, respectively For example, by the fragmentation layer 6 of two sheets which thickness becomes from the layer which is 0.6nm

(Au+SiO2), it trichotomizes and divides into every 10 sets of Pd layers and Co layers.
[0048] Next, with reference to drawing 7 , other examples of magnetic-recording data medium of the gestalt of operation of this invention are explained. By this magnetic-recording data medium, since a substrate 1, a glue line 2, the laminating magnetic-recording layer 4, and a protective layer 5 are the same as an example of magnetic-recording data medium of drawing 1 , that explanation is omitted.
[0049] This magnetic-recording data medium minds a glue line (for example, Ti layer of 1nm thickness) 2. The soft magnetism layer 7 which consists of NiFe, CoZr, or FeN by which covering formation was carried out on the substrate (for example, glass plate) 1, Either of the metals of the face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu formed on the soft magnetism layer 7, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, ZnO, ZrO, and Y2 -- either of the oxides, such as O3 and HfO, (or Si3 N4 --) It consists of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN. Thickness The with a 1nm or more thickness [thickness 30nm or less] composite-material layer 8, It has the laminating magnetic-recording layer 4 which consists of Pt layer (or Pd layer) and Co layer which were formed on the composite-material layer 8.
[0050] Now, if a soft magnetism layer is allotted to the magnetic-recording layer bottom for vertical recording, it will be known that record transition can be written clearly, but on the other hand the noise of a magnetic-recording layer will increase in many cases. Then, as mentioned above, if the above-mentioned composite-material layer 8 is inserted between the soft magnetism layer 7 and the laminating magnetic-recording layer 4, the noise generated in a magnetic-recording layer can be reduced.
[0051] When the thickness of the composite-material layer 8 is thinner than 1nm, the noise reduction effect is not acquired, but when thicker than 30nm, the distance between the laminating magnetic-recording layer 4 and the soft magnetism layer 7 separates too much, and the above-mentioned effect by the soft magnetism layer 7 becomes small.
[0052] In the example of drawing 7 , thickness uses 0.6nm Pd layer and the thing to which the laminating of the 0.6nm Co layer was carried out at a time for 20 thickness by turns, respectively as a laminating magnetic-recording layer 4 as a composite-material layer 8 using the layer whose thickness is 10nm (Au+SiO2), using for example, a NiFe layer as a soft magnetism layer 7.
[0053] Next, with reference to drawing 8 , other examples of magnetic-recording data medium of the gestalt of operation of this invention are explained. By this magnetic-recording data medium, since a substrate 1, a glue line 2, the substrate layer 3, the laminating magnetic-recording layer 4, and a protective layer 5 are the same as an example of magnetic-recording data medium of drawing 1 , that explanation is omitted.
[0054] In magnetic-recording data medium of drawing 1 , if the laminating magnetic-recording layer 4 on the substrate layer 3 which consists of composite material is thin, reduction in coercive force will arise.
[0055] This magnetic-recording data medium consists of either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of that metal) between the laminating magnetic-recording layer 4 and the substrate layer 3, and the with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer 9 is made to come to be placed between it in magnetic-recording data medium concerning drawing 1 . By inclusion of this coercive force lowering control layer 9, lowering of coercive force when the laminating magnetic-recording layer 4 is thin can be controlled.
[0056] In the example of drawing 8 , the holding power lowering control layer 9 consists for example, of a Pt layer.
[0057] Next, drawing 9 is explained. Carry out the laminating of Pd layer whose thickness of five sheets is 0.5nm, respectively, and the Co layer whose thickness is 0.6nm by turns, and the laminating magnetic-recording layer 4 is constituted. Pt is 50% and SiO2. The layer which consists of 50% and whose thickness is 30nm (Pt+SiO2) is used. Inserting the coercive force lowering control layer 9 which consists of Pd between the laminating magnetic-recording layer 4 and the substrate layer 3, other configurations show the characteristic curve which shows the relation between the thickness of Pd layer, the coercive force (Hc) of the laminating magnetic-recording layer 4, and (kOe) to drawing 9 in magnetic-recording data medium made to be the same as that of drawing 8 . When the thickness of Pd layer is 3-5nm, coercive force (Hc) serves as a peak (the peak value is abbreviation 2.5kOe).
[0058] Next, with reference to drawing 10 , other examples of magnetic-recording data medium of the gestalt of operation of this invention are explained. By this magnetic-recording data medium, since a substrate 1, a glue line 2, the substrate layer 3, and a protective layer 5 are the same as an example of magnetic-recording data medium of drawing 6 , that explanation is omitted.
[0059] In magnetic-recording data medium of drawing 6 , if each class of the laminating magnetic-recording layer 4 divided by the fragmentation layer 6 which consists of composite material is thin, reduction in coercive force will arise.
[0060] Then, magnetic-recording data medium of this drawing 10 is set to magnetic-recording data medium concerning drawing 6 . Between each class divided by the fragmentation layer 6 of the laminating magnetic-recording layer 4, and

the fragmentation layer 6 It consists of either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of the metal), and the with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer 9 is made to come to intervene. By inclusion of this coercive force lowering control layer 9, lowering of coercive force when each class divided by the fragmentation layer 6 of the laminating magnetic-recording layer 4 is thin can be controlled.

[0061] Next, the modification of the example of magnetic-recording data medium of drawing 10 is explained. In magnetic-recording data medium of drawing 6 , if the laminating magnetic-recording layer 4 on the substrate layer 3 which consists of composite material is thin, reduction in coercive force will arise.

[0062] In magnetic-recording data medium which the modification of the example of magnetic-recording data medium of drawing 10 requires for ** which omits a graphic display, and drawing 6 in a laminating magnetic-recording layer A coercive force lowering control layer is not prepared. Between a laminating magnetic-recording layer and a substrate layer Pt, It consists of either of the metals of face-centered legislation structures, such as Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of the metal), and a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer is made to come to intervene. By inclusion of this coercive force lowering control layer, lowering of coercive force when a laminating magnetic-recording layer is thin can be controlled. The holding power lowering control layer in this case also consists of a Pt layer.

[0063] Next, other modifications of the example of drawing 10 are explained. Magnetic-recording data medium of other modifications between each class divided by the fragmentation layer of a laminating magnetic-recording layer, and a fragmentation layer like ** which omits a graphic display, and magnetic-recording data medium of drawing 10 It consists of either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of the metal). While the with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer 9 is made to come to intervene It differs from drawing 10 . Also between a laminating magnetic-recording layer and a substrate layer Pt, Au, It consists of either of the metals of face-centered legislation structures, such as Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of the metal), and a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer is made to come to intervene. While being able to control lowering of coercive force when each class divided by the fragmentation layer of a laminating magnetic-recording layer is thin by inclusion of the coercive force lowering control layer in a laminating magnetic-recording layer according to this magnetic-recording data medium, lowering of coercive force when the laminating magnetic-recording layer 4 is thin can be controlled by inclusion of the coercive force lowering control layer between a laminating magnetic-recording layer and a substrate layer.

[0064] Next, with reference to drawing 11 , other examples of magnetic-recording data medium of the gestalt of operation of this invention are explained. By this magnetic-recording data medium, since a substrate 1, a glue line 2, the laminating magnetic-recording layer 4, a protective layer 5, and the soft magnetism layer 7 are the same as an example of magnetic-recording data medium of drawing 7 , that explanation is omitted.

[0065] In magnetic-recording data medium of drawing 7 , if the laminating magnetic-recording layer 4 on the composite-material layer 8 is thin, reduction in coercive force will arise.

[0066] Then, magnetic-recording data medium of drawing 11 consists of either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of this metal), and makes the with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer 9 intervene between the laminating magnetic-recording layer 4 and the composite-material layer 8 in magnetic-recording data medium of drawing 7 . According to magnetic-recording data medium of this drawing 11 , by inclusion of this coercive force lowering control layer 9, even if the laminating magnetic-recording layer 4 is thin, coercive force lowering can be controlled.

[0067] For example, Pt layer as a coercive force lowering control layer 9 is made to intervene between the laminating magnetic-recording layer 4 and the composite-material layer 8 in the example of drawing 11 .

[0068]

[Example] Next, with reference to the table Fig. of drawing 12 , the coercive force (kOe) and S/N (dB) of magnetic-recording data medium of the layer system and layer system of the example of magnetic-recording data medium of the gestalt of operation of this invention are shown.

[0069] The Co layer 15 whose thickness which Example a belongs to magnetic-recording data medium of the type of drawing 8 , and contains Cr as an impurity is 0.5nm, i.e., Co85Cr, In magnetic-recording data medium which has the laminating magnetic-recording layer to which the laminating of the Pd layer whose thickness is 1nm was carried out 30 sheets at a time by turns, respectively, and the substrate [in which thickness is 15nm] layer which it becomes from 80% of Ag, and 20% of composite material of Ag and MgO by the volume ratio, respectively The coercive force lowering

control layer which consists of a Pd layer and whose thickness is 3nm was made to intervene between a laminating magnetic-recording layer and a substrate layer, and coercive force and S/N are 2.6kOe(s) and 28dB, respectively.
[0070] The Co layer 15 whose thickness which Example b belongs to magnetic-recording data medium of the modification of the type of drawing 10 , and contains Cr as an impurity is 0.5nm, i.e., Co85Cr, The laminating magnetic-recording layer to which the laminating of the Pd layer whose thickness is 1nm was carried out 15 sheets at a time by turns, respectively, Consist of 80% of Ag, and 20% of composite material of Ag and MgO by the volume ratio, respectively. By the fragmentation layer which magnetic-recording data-medium ******** which has a substrate [in which thickness is 15nm] layer, and a laminating magnetic-recording layer turn into from 80% of Ag, and 20% of composite material of Ag and MgO by the volume ratio, respectively, whose thickness is 3nm, respectively and whose number is two While being trichotomized, the coercive force lowering control layer which thickness becomes from Pd layer which is 3nm was made to intervene between a laminating magnetic-recording layer and a substrate layer, and coercive force and S/N are 2.2 and 32, respectively.
[0071] The Co layer 15 whose thickness in which Example c belongs to magnetic-recording data medium of the modification of the type of drawing 10 , and contains Cr as an impurity is 0.5nm, i.e., Co85Cr, The laminating magnetic-recording layer to which the laminating of the Pd layer whose thickness is 1nm was carried out ten sheets at a time by turns, respectively, Consist of 80% of Ag, and 20% of composite material of Ag and MgO by the volume ratio, respectively. By the fragmentation layer which magnetic-recording data-medium ******** which has a substrate [in which thickness is 15nm] layer, and a laminating magnetic-recording layer turn into from 80% of Ag, and 20% of composite material of Ag and MgO by the volume ratio, respectively, whose thickness is 3nm, respectively and whose number is three While being quadrisected, the coercive force lowering control layer which thickness becomes from Pd layer which is 3nm was made to intervene between a laminating magnetic-recording layer and a substrate layer, and coercive force and S/N are 1.7 and 33, respectively.
[0072] The Co layer 15 whose thickness which the gestalt d of operation belongs to magnetic-recording data medium of other modifications of the type of drawing 10 , and contains Cr as an impurity is 0.5nm, i.e., Co85Cr, The laminating magnetic-recording layer to which the laminating of the Pd layer whose thickness is 1nm was carried out ten sheets at a time by turns, respectively Between either of each class which was divided by four layers in the fragmentation layer of three sheets which consists of 80% of Ag, and 20% of composite material of Ag and MgO by the volume ratio, respectively, and was divided into four layers in the fragmentation layer of three sheets of a laminating magnetic-recording layer, and a fragmentation layer While allotting the coercive force lowering control layer which consists of a Pd layer, between a laminating magnetic-recording layer and the substrate layer which consists of 80% of Ag, and 20% of composite material of Ag and MgO by the volume ratio, respectively The coercive force lowering control layer whose thickness it is thin from Pd layer is 1nm is made to come to intervene, and the coercive force and S/N are 2.5 and 36, respectively.
[0073] If the number of partitions by the fragmentation layer of a laminating magnetic-recording layer is increased from the coercive force and S/N of an example of this drawing 12 by drawing 6 , drawing 8 , and magnetic-recording data medium of the type of drawing 10 , S/N will improve, but although coercive force tends to decrease a little, while being able to control that coercive force lowering by preparing the coercive force lowering control layer like Pd layer, it turns out that lowering of S/N is also improved.
[0074] Next, with reference to the table Fig. of drawing 13 , the coercive force (kOe) and S/N (dB) of magnetic-recording data medium of the conventional example which should be compared with the example of magnetic-recording data medium of the gestalt of operation of this invention and this are shown.
[0075] The conventional example is magnetic-recording data medium which carried out the laminating of the Pd layer whose thickness is 20nm to the laminating magnetic-recording layer bottom which piled up at a time by turns 20 Pd layers whose Co layers and thickness whose thickness is 0.4nm are 0.6nm, respectively, and coercive force and S/N are 3.4kOe(s) and 12dB, respectively.
[0076] It is magnetic-recording data medium by which Example e belongs to the type of drawing 1 , and Co layer whose thickness is 0.6nm, and Pt layer whose thickness is 1nm consist of a laminating magnetic-recording layer by which the laminating was carried out 15 sheets at a time, respectively, and a substrate layer of the composite material which consists of 70% of Rh, and 30% of TiN by the volume ratio, respectively, and the coercive force and S/N are 2.2kOe(s) and 28dB, respectively.
[0077] The laminating magnetic-recording layer by which Example f belonged to the type of drawing 8 , and the laminating of Co whose thickness is 1nm, and every 30 Pt layers whose thickness is 0.5nm was carried out mutually, respectively, They are 60% of Ir, and 40% of Si3 N4 at a volume ratio, respectively. In magnetic-recording data medium which has a substrate [in which the thickness it is thin from composite material is 40nm] layer In the case where the

coercive force lowering control layer which thickness becomes from Pd layer which is 3nm is made to intervene between a laminating magnetic-recording layer and a substrate layer, coercive force and S/N are 1.7 and 25, respectively.

[0078] The laminating magnetic-recording layer by which Example g belonged to the type of drawing 8 , and the laminating of Co whose thickness is 1nm, and every ten Pt layers whose thickness is 0.5nm was carried out mutually, respectively, a volume ratio -- respectively -- 50% of Pt, and 50% of Si3 N4 In magnetic-recording data medium which has a substrate [in which thin thickness is 20nm] layer from -- In the case where the coercive force lowering control layer which thickness becomes from Pd layer which is 3nm is made to intervene between a laminating magnetic-recording layer and a substrate layer, coercive force and S/N are 1.5 and 30, respectively.

[0079] It is magnetic-recording data medium by which Example h belongs to the type of drawing 1 , and Co layer whose thickness is 0.6nm, and Pt layer whose thickness is 1nm consist of a laminating magnetic-recording layer by which the laminating was carried out 20 sheets at a time, respectively, and a substrate layer of the composite material which consists of 70% of Au, and 30% of SiC by the volume ratio, respectively, and the coercive force and S/N are 2.3kOe(s) and 33dB, respectively.

[0080] Ten layers of Co layers whose thickness which Example i belongs to the type of drawing 8 , and contains Impurity nickel is 0.7nm, i.e., Co90nickel, The laminating magnetic-recording layer by which the laminating of every 30 Pt layers whose thickness is 0.8nm was carried out mutually, respectively, a volume ratio -- respectively -- 70% of Pt layer, and 30% of Y2 O3 In magnetic-recording data medium by which the thickness which consists of becoming composite material consists of a substrate layer which is 15nm from -- Coercive force and S/N are 2.0 and 30, respectively in the case where the fragmentation layer which thickness becomes from Pt layer which is 3nm is inserted between a laminating magnetic-recording layer and a substrate layer.

[0081] Example j belongs to the type of drawing 10 , and it has the laminating magnetic-recording layer to which the laminating of Co layer whose thickness is 0.6nm, and the Pd layer whose thickness is 0.5nm was carried out by turns. While the thickness which the laminating magnetic-recording layer becomes from 90% of Au and 10% of ZrN by the volume ratio, respectively is divided into two-layer by the fragmentation layer which is one sheet which is 5nm between a fragmentation layer and the divided laminating magnetic-recording layers -- nickel80Fe15Ta5 from -- it is magnetic-recording data medium in which the coercive force lowering control layer whose thin thickness is 20nm was made to insert, and S/N is 32.

[0082]

[Effect of the Invention] In magnetic-recording data medium which has the laminating magnetic-recording layer which consists of a Pt layer (or Pd layer) and a Co layer, and a substrate layer to the laminating magnetic-recording layer according to the 1st this invention a substrate layer Either of the metals of the face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) Since it comes to consist of composite-material layers which consist of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN The transition noise in a laminating magnetic-recording layer can decrease substantially, and can obtain suitable magnetic-recording data medium for short wavelength record.

[0083] In magnetic-recording data medium which has the laminating magnetic-recording layer which consists of a Pt layer (or Pd layer) and a Co layer according to the 2nd this invention a laminating magnetic-recording layer Either of the metals of the face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) It consists of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN. Thickness by 0.3nm or more fragmentation layer 10nm or less Since it comes to be divided into two or more layers, even if a laminating magnetic-recording layer is thick, buildup of crystal grain can be suppressed and magnetic-recording data medium which can control deterioration of S/N can be obtained.

[0084] In magnetic-recording data medium which has the laminating magnetic-recording layer which consists of a Pt layer (or Pd layer) and a Co layer, and a substrate layer to the laminating magnetic-recording layer according to the 3rd this invention a substrate layer Either of the metals of the face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) While coming to consist of composite-material layers which consist of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN A laminating magnetic-recording layer Either of the metals of the face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2O3, and HfO, (or Si3 N4 --) It consists of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN,

BN, Tin, ZrN, and GaN. Thickness by 0.3nm or more fragmentation layer 10nm or less Since it comes to be divided into two or more layers, while the transition noise in a laminating magnetic-recording layer decreases substantially and becomes suitable for short wavelength record, even if a laminating magnetic-recording layer is thick, buildup of crystal grain can be suppressed and magnetic-recording data medium which can control deterioration of S/N can be obtained.
[0085] The soft magnetism layer which consists of NiFe, CoZr, or FeN according to the 4th this invention, Either of the metals of the face-centered legislation structure of Pt, Au, Pd, Ag, Rh, Ir, and Cu formed on the soft magnetism layer, SiO2, aluminum 2O3, MgO, TiO2, Li2 O, CaO, either of the oxides, such as ZnO, ZrO, Y2 O3, and HfO, (or Si3 N4 --) It consists of one (or either of carbide, such as SiC, TiC, ZrC, and TaC) composite material of the nitrides, such as AlN, BN, Tin, ZrN, and GaN. Thickness A with a 1nm or more thickness [thickness 30nm or less] composite-material layer, Since it has the laminating magnetic-recording layer which consists of Pt layer (or Pd layer) and Co layer which were formed on the composite-material layer While being able to write record transition clearly, magnetic-recording data medium which can control the increment in the noise in a laminating magnetic-recording layer by existence of the soft magnetism layer can be obtained.
[0086] According to the 5th this invention, it sets to the 1st this invention. Between a laminating magnetic-recording layer and a substrate layer Since it consists of either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of the metal) and a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer is made to come to intervene While the transition noise in a laminating magnetic-recording layer decreases substantially and becomes suitable for short wavelength record, even if a laminating magnetic-recording layer is thin, magnetic-recording data medium which can control lowering of coercive force can be obtained.
[0087] According to the 6th this invention, in the 2nd this invention, between each class divided by the fragmentation layer of a laminating magnetic-recording layer, and a fragmentation layer Since it consists of either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of the metal) and a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer is made to come to intervene Even if a laminating magnetic-recording layer is thick, while being able to suppress buildup of crystal grain and being able to control deterioration of S/N, even if each class divided by the fragmentation layer of a laminating magnetic-recording layer becomes thin, magnetic-recording data medium which can control lowering of coercive force can be obtained.
[0088] According to the 7th this invention, in the 3rd this invention, between each class divided by the fragmentation layer of a laminating magnetic-recording layer, and a fragmentation layer Since it consists of either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of the metal) and a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer is made to come to intervene While the transition noise in a laminating magnetic-recording layer can decrease substantially, and it can become suitable for short wavelength record, buildup of crystal grain can be suppressed even if a laminating magnetic-recording layer is thick, and being able to control deterioration of S/N Even if each class divided by the fragmentation layer of a laminating magnetic-recording layer becomes thin, magnetic-recording data medium which can control lowering of coercive force can be obtained.
[0089] According to the 8th this invention, it sets to the 3rd this invention. Between a laminating magnetic-recording layer and a substrate layer Since it consists of either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of the metal) and a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer is made to come to intervene While the transition noise in a laminating magnetic-recording layer can decrease substantially, and it can become suitable for short wavelength record, buildup of crystal grain can be suppressed even if a laminating magnetic-recording layer is thick, and being able to control deterioration of S/N Even if a laminating magnetic-recording layer is thin, magnetic-recording data medium which can control lowering of coercive force can be obtained.
[0090] According to the 9th this invention, it sets to the 4th this invention. Between a laminating magnetic-recording layer and a composite-material layer Since it consists of either of the metals of face-centered legislation structures, such as Pt, Au, Pd, Ag, Rh, Ir, aluminum, nickel, and Cu, (or either of the alloys of the metal) and a with a 0.3nm or more thickness [thickness 5nm or less] coercive force lowering control layer is made to come to intervene While being able to write record transition clearly, magnetic-recording data medium which can control the increment in the noise in a laminating magnetic-recording layer by existence of the soft magnetism layer, and can control lowering of coercive force even if a laminating magnetic-recording layer is thin can be obtained.
[0091] While being able to suppress buildup of crystal grain and being able to control deterioration of S/N even if a laminating magnetic-recording layer is thick since it comes to set the thickness of each class divided by the composite-

material layer of a laminating magnetic-recording layer as 3nm or more 20nm or less in the 2nd this invention according to the 10th this invention, magnetic-recording data medium by which sufficient coercive force is acquired and sufficient noise reduction effect is acquired can be obtained.

[0092] Since it comes to set the thickness of each class divided by the composite-material layer of a laminating magnetic-recording layer as 3nm or more 20nm or less in the 3rd this invention according to the 11th this invention While the transition noise in a laminating magnetic-recording layer can decrease substantially, and it can become suitable for short wavelength record, buildup of crystal grain can be suppressed even if a laminating magnetic-recording layer is thick, and being able to control deterioration of S/N Magnetic-recording data medium by which sufficient coercive force is acquired and sufficient noise reduction effect is acquired can be obtained.

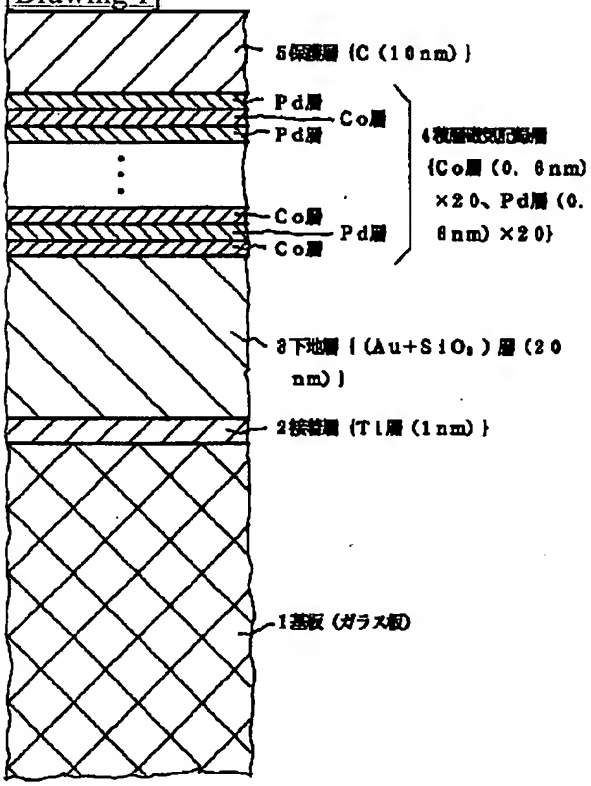
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

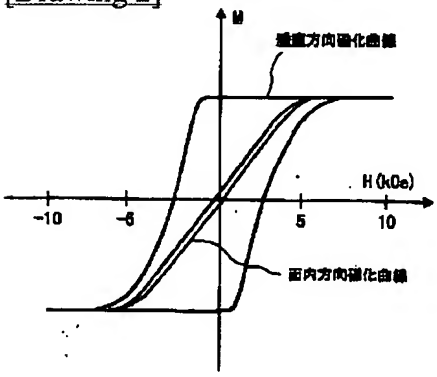
DRAWINGS

[Drawing 1]



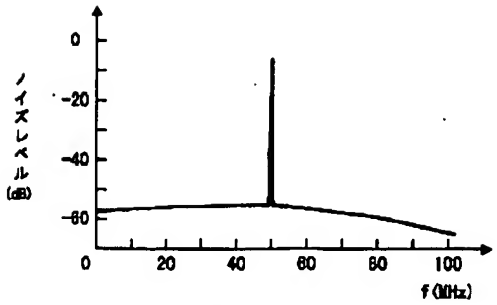
磁気記録媒体の例

[Drawing 2]



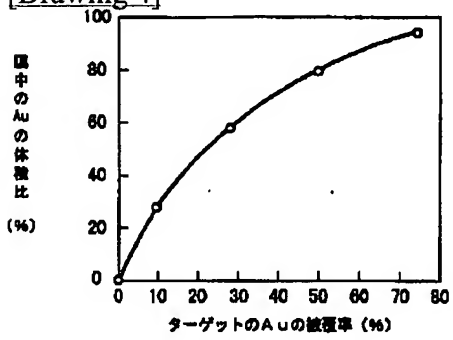
実施の形態の媒体の磁化曲線

[Drawing 3]



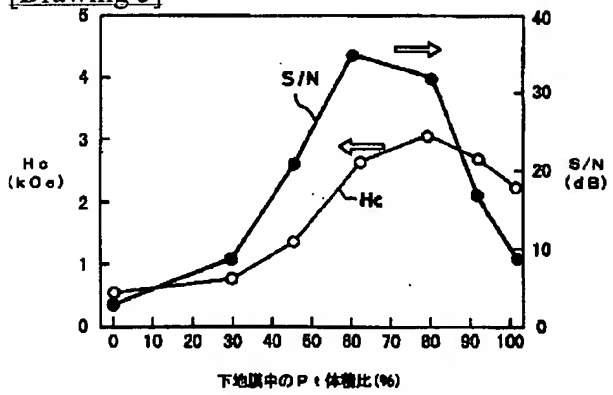
実施の形態の媒体の再生スペクトル

[Drawing 4]



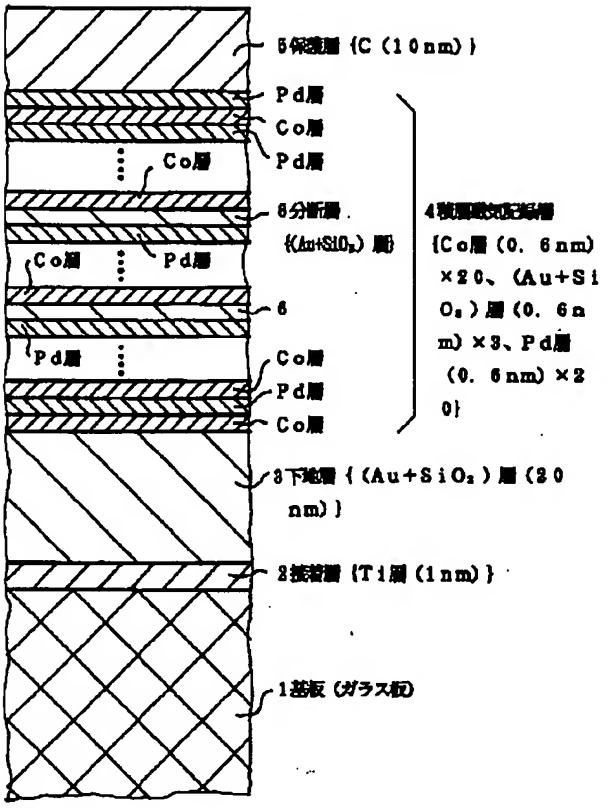
特 性 曲 線

[Drawing 5]



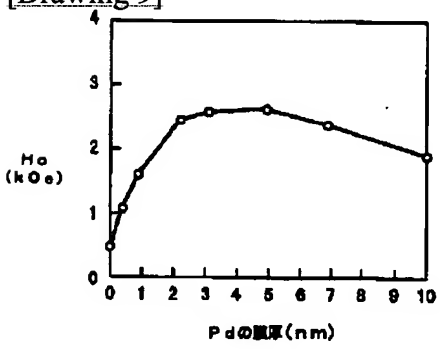
特 性 曲 線

[Drawing 6]



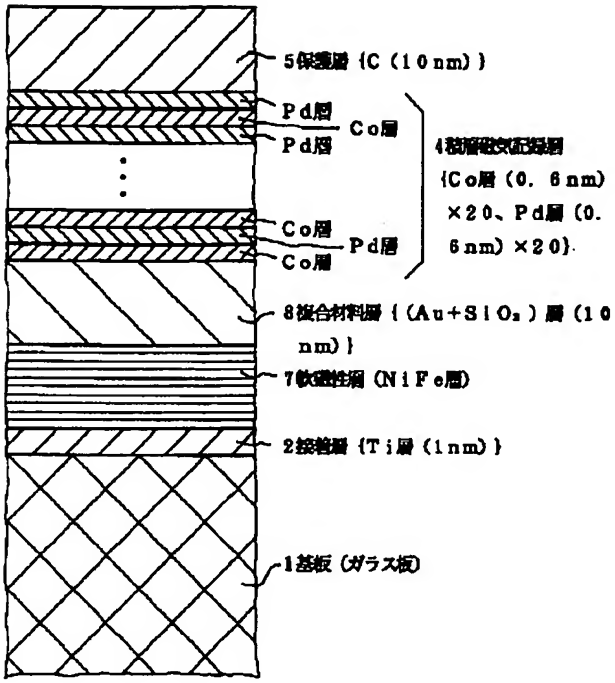
磁気記録媒体の例

[Drawing 9]



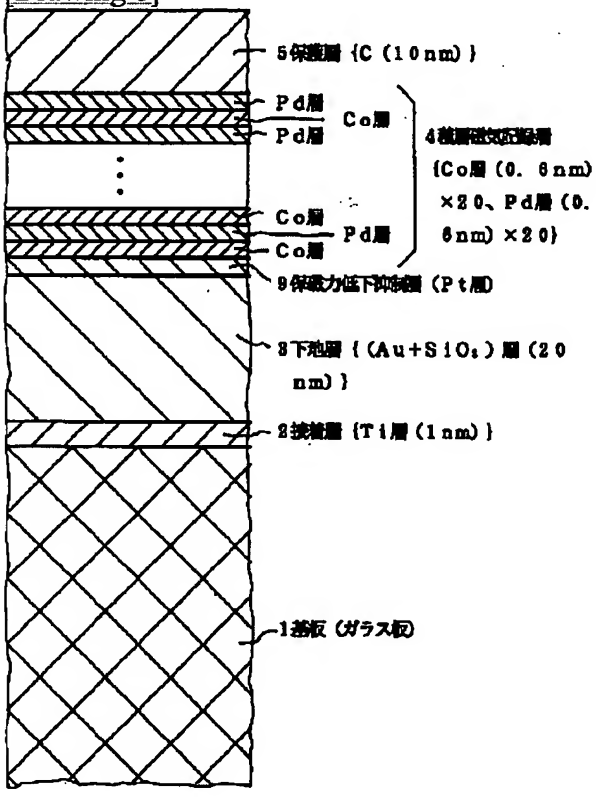
特性曲線

[Drawing 7]



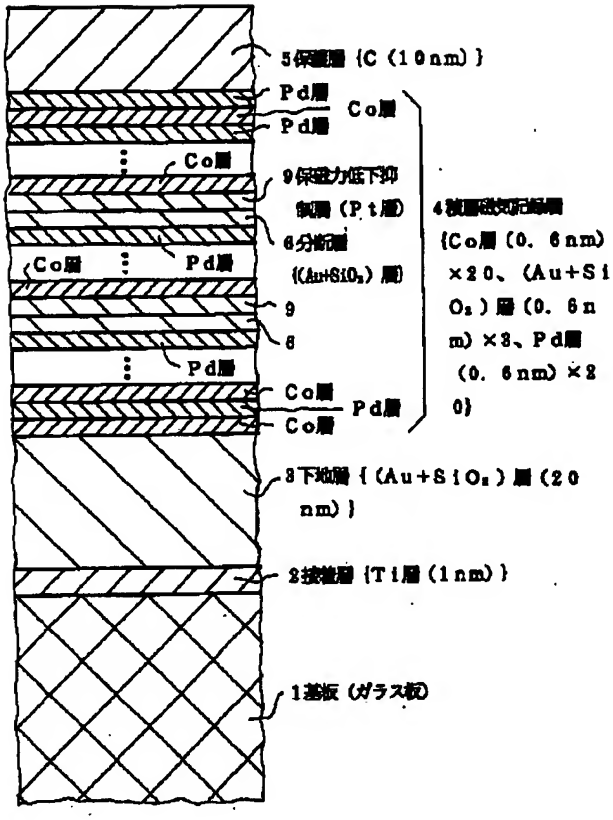
磁気記録媒体の例

[Drawing 8]



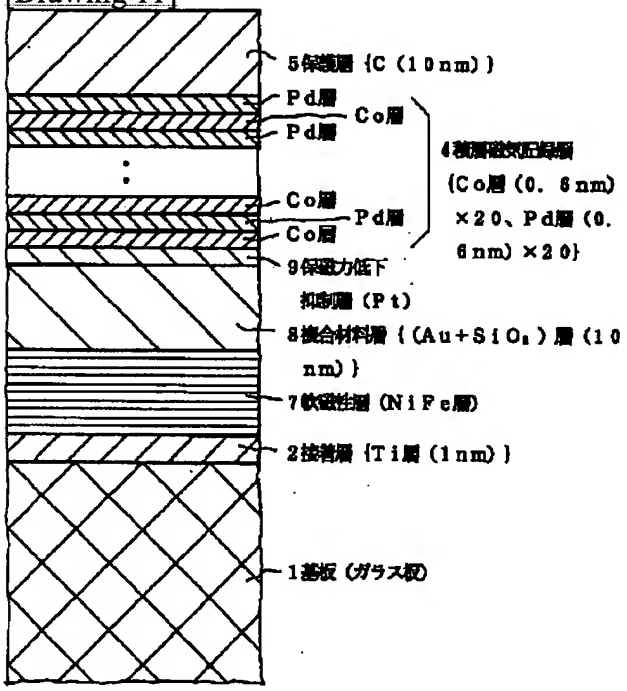
磁気記録媒体の例

[Drawing 10]



磁気記録媒体の例

[Drawing 11]



磁気記録媒体の例

[Drawing 12]

実施例の識別記号	磁気記録媒体の層構造	保磁力 (kOe)	S/N (dB)
実施例a	($Co_{88}Cr_{12}$:0.5nm／Pd:1nm) ×30／Pd:3nm／(80% Ag+20% MgO):15nm	2.6	28
実施例b	[($Co_{88}Cr_{12}$:0.5nm／Pd:1nm) ×15／(80% Ag+20% MgO):2nm〕×2／Pd:3nm／(80% Ag+20% MgO):15nm	2.2	32
実施例c	[($Co_{88}Cr_{12}$:0.5nm／Pd:1nm) ×10／(80% Ag+20% MgO):3nm]×3／Pd:3nm／(80% Ag+20% MgO):15nm	1.7	33
実施例d	[($Co_{88}Cr_{12}$:0.5nm／Pd:1nm) ×10／Pd:1nm／(80%Ag+20% MgO):3nm]×3／Pd:3nm／(80%Ag+20% MgO):15nm	2.5	36

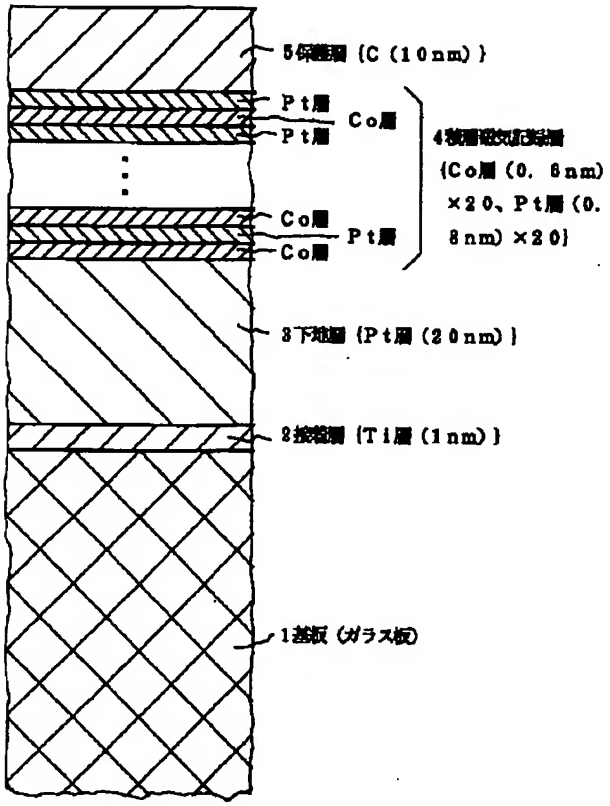
実施例の保磁力及びS／N

[Drawing 13]

従来例と実施例の識別記号	磁気記録媒体の層構造	保磁力 (kOe)	S/N (dB)
従来例	(Co:0.4nm／Pd:0.6nm) ×20／Pd:20nm	3.4	12
実施例e	(Co:0.6nm／Pt:1nm) ×15／(70% Rh+30% TiN):20nm	2.2	28
実施例f	($Co_{88}Cr_{12}$:0.5nm／Pt:0.6nm) ×30／Pt:2nm／(60% Ir+40% BN):40nm	1.7	25
実施例g	(Co:1nm／Pd:0.5nm) ×10／Pd:3nm／(50% Pt+50% Si_3N_4):20nm	1.5	30
実施例h	(Co:0.6nm／Pt:1nm) ×20／(70% Au+30% SiC):30nm	2.3	33
実施例i	($Co_{80}Ni_{10}$:0.7nm／Pt:0.8nm) ×30／Pt:3nm／(70%Pt+30% Y_2O_3):15nm Y_2O_3):15nm	2.0	30
実施例j	(Co:0.6nm／Pd:0.5nm) ×20／(90% Au+10%ZrN):5nm／$Ni_{80}Fe_{12}Ta_8$:20nm	——	32

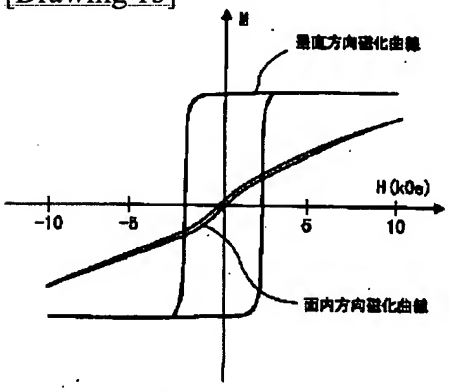
従来例と実施例の保磁力及びS／Nの比較

[Drawing 14]



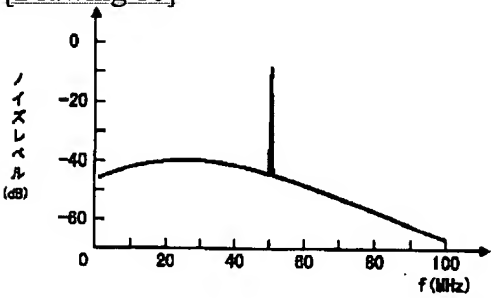
従来の磁気記録媒体

[Drawing 15]



従来の媒体の磁化曲線

[Drawing 16]



従来の媒体の再生スペクトル

[Translation done.]